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LEO C. MASSOPUST,
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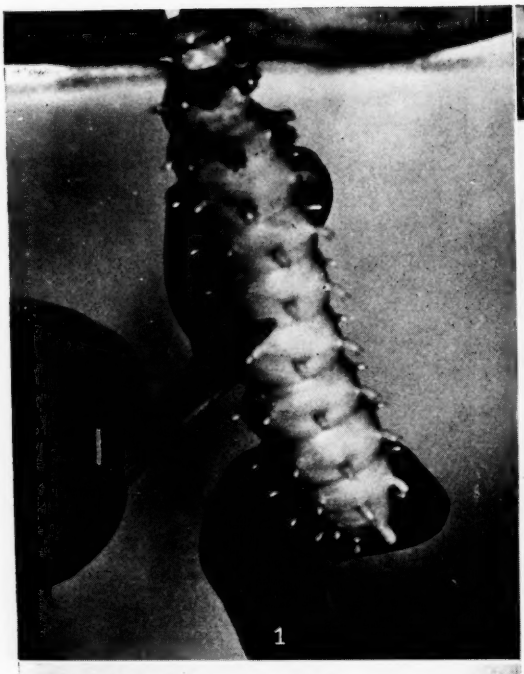
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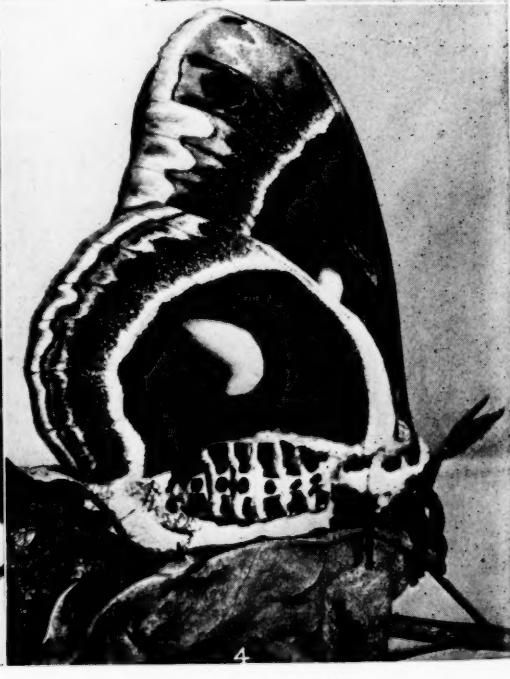
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Metamorphosis of the Samia Cecropia

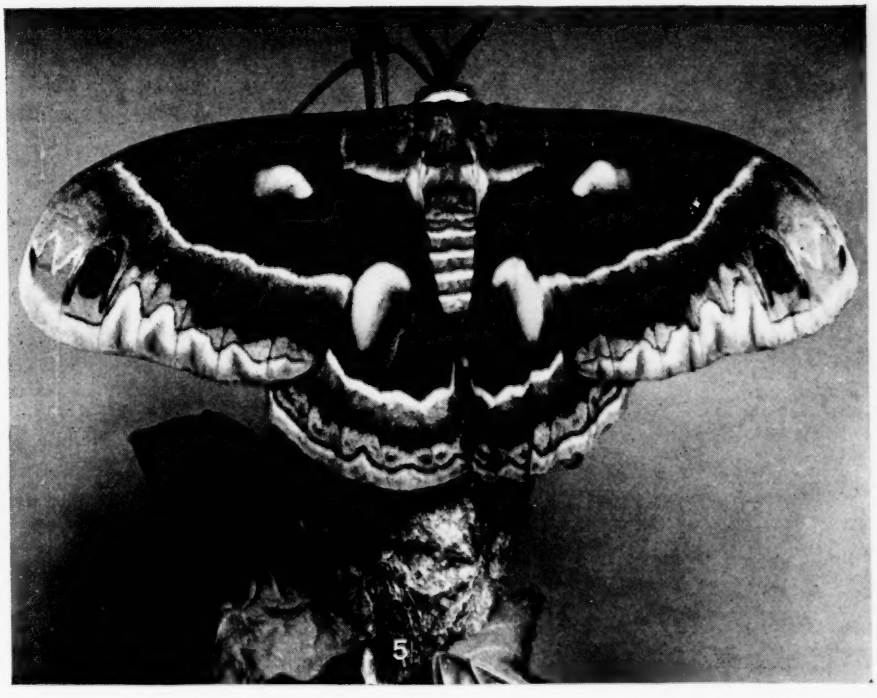
by Ray Miess*

IT is often important to produce a connected photographic record of a subject, especially in the field of biology. Such records are not obtained automatically by proper exposure and clear cut detail, but should also constitute good pictures which tell a story.

This brief presentation does not presume to be a scientific discussion of the metamorphosis of the Samia Cecropia, but rather a pictorial story of this interesting phenomenon.

During the summer of 1941, a large caterpillar, figure 1, was found on a lilac bush. It measured 125 mm. in length, and 18 mm. in

* Milwaukee, Wisconsin. Received for publication March 12, 1942.



diameter. It was placed in a large screened box, which afforded an excellent means of observing its activities. Fresh lilac branches and leaves were placed in the box at regular intervals. After several weeks the caterpillar began spinning its cocoon. It was interesting to note the systematic and efficient procedure employed in this process. After about three hours the caterpillar was completely enclosed in the cocoon.

The cocoon and the branch to which it was attached were carefully removed from the box, mounted upright on a small base, and set aside for the winter, figure 2. It was kept indoors in a conspicuous place, at ordinary room temperature.

On April 23, a tapping noise was heard emanating from the mounted cocoon. Upon inspection it was noted that the moth was beginning to emerge. After some effort on the the part of the moth it emerged completely. The wings were small, and folded close to the body, figure 3. After attaching itself to the branch above the empty cocoon, it proceeded to inflate its moist wings by intermittently pumping its body fluids into them. Between these intermittent efforts the wings were vibrated gently and rapidly until they were dry. In a short time the wings were fully inflated, figure 4. This moth was a beautiful specimen, having a wing spread of 165 mm., figure 5. The body was a brilliant rust color, banded in yellow. The tan colored wings were decorated with brilliant yellow and irridescent green gold spots. The outer edges were tinted a pale orchid.

Figures 1-5 were taken with a Voightlander Bergheil 6.5 x 9 cm. Heliar F. 4.5. The illumination, the General Electric Speed Midget open flash at F.22. Exposure time 1/200 sec. Agfa Isopan cut film was used and developed in DK 20. The prints were made on Kodabromide paper and developed in amidol.

It is obvious that a connected photographic sequence such as herein presented is not only instructive from the biological standpoint, but also serves as a permanent and complete record of important events which cannot be repeated.

A Vertical Stereocamera for Biological Photography

by Chester H. Heuser and Osborne O. Heard*

THE camera described has evolved from experience in a particular field of photography in the Department of Embryology of the Carnegie Institution of Washington. The camera embodies features peculiar to the requirements of the embryologist, but it may also serve for general biological work where rigidity and precision are needed. Critical photomicrographic work may also be carried out with minimum effort. It will be noted that the stereoscopic feature has greatly influenced the design but this in no way impairs the device for ordinary vertical work. Another desirable feature in embryological work is the ability to set the camera for a given magnification which in turn demands that the entire bellows, lens board, and plate holder be moved into focus as a unit. This feature further influenced the design when stereoscopic work was contemplated, since the object to be photographed must be moved into focus and posed at the pivotal plane of the camera. To facilitate the placing of the specimen to be photographed in this plane, it was necessary to devise an adjustable focusing stand of rigid design and to arrange a binocular dissecting microscope for viewing and posing specimens. These desirable features were incorporated in the design. To accomplish this the dissecting microscope was mounted on a pivoted arm which allowed it to be moved in and out of the optical axis as desired. Hence the image of an object which has been posed under the microscope will fall centrally on the photographic plate. The placing of the specimen at this precise level is accomplished with the aid of the dissecting microscope, which is permanently focused in the horizontal plane of the pivot, by moving the specimen with an adjustable stand to the focus of the microscope. This is imperative if two images taken at different angles for stereographs are to fall on comparable areas of the plates. Another desirable feature is the ability to set the camera at will for any given magnification. This is effected by integrating the lens board and plate holder so that the distance between them remains constant during the focusing process and therefore the magnification does not change.

* From the Department of Embryology, Carnegie Institution of Washington, Baltimore, Maryland.

Received for publication July 13, 1942.

The plate size of the reversible back is 4″ x 5″. The vertical member carries a 5″ x 7″ mirror on a movable arm which affords a convenient method of observing the image without climbing to view it on the ground glass. There are several features of the design and construction that should commend themselves to biologists doing similar work and it is hoped that the following general description may be of value.

DESIGN

In order to obtain an apparatus with a high degree of stability patterns were specially designed to furnish heavy castings. The entire assembly weighs approximately 200 pounds and is adequate for critical photomicrography.

The base and vertical support, figure 1, are made of two separate castings, machined and bolted together to form a rigid unit. To these are attached various essential elements. The "geometric slide" principle of Lord Kelvin, figure 2, has been used throughout to carry the camera back and lens board. Seamless steel tubes forming the ways for the slide are held together by accurately machined castings of grey iron. These tubes are in two pairs, figure 3. The back tubes serve to support the front tubes which comprise the slide proper and, furthermore, act as a tilting unit for stereoscopic work. The right back tube functions as a stationary part of a hinge, figure 3, permitting the entire camera to be swung out of the way when posing a specimen with the aid of the binocular microscope, as well as allowing the front tubes to be free so that the entire camera assembly can be focused. The top and bottom front tube castings are alike. The back portion of the right end of each is fashioned as the movable part of a sliding hinge, figure 3, and is essentially a loosely fitting yoke placed over the tube. The inner surface of the yoke carries three points of contact, equally spaced and accurately machined. To prevent any displacement of the optical axis of the camera assembly while focusing two of the points are positive and the third is under spring tension. The stationary points are so arranged that they remain in firm contact with the pin of the hinge in the vertical position whereas the tension points prevent displacement when the camera is tilted and furthermore allows for any variation in the size of the tube when the hinges slide during the process of focusing.

Collars with set screws have been placed on the right hand tube of the front unit to facilitate resetting the lens holder and camera support at any desired position. The castings which tie together the tubes of the camera assembly have projecting pads that bear against the left back

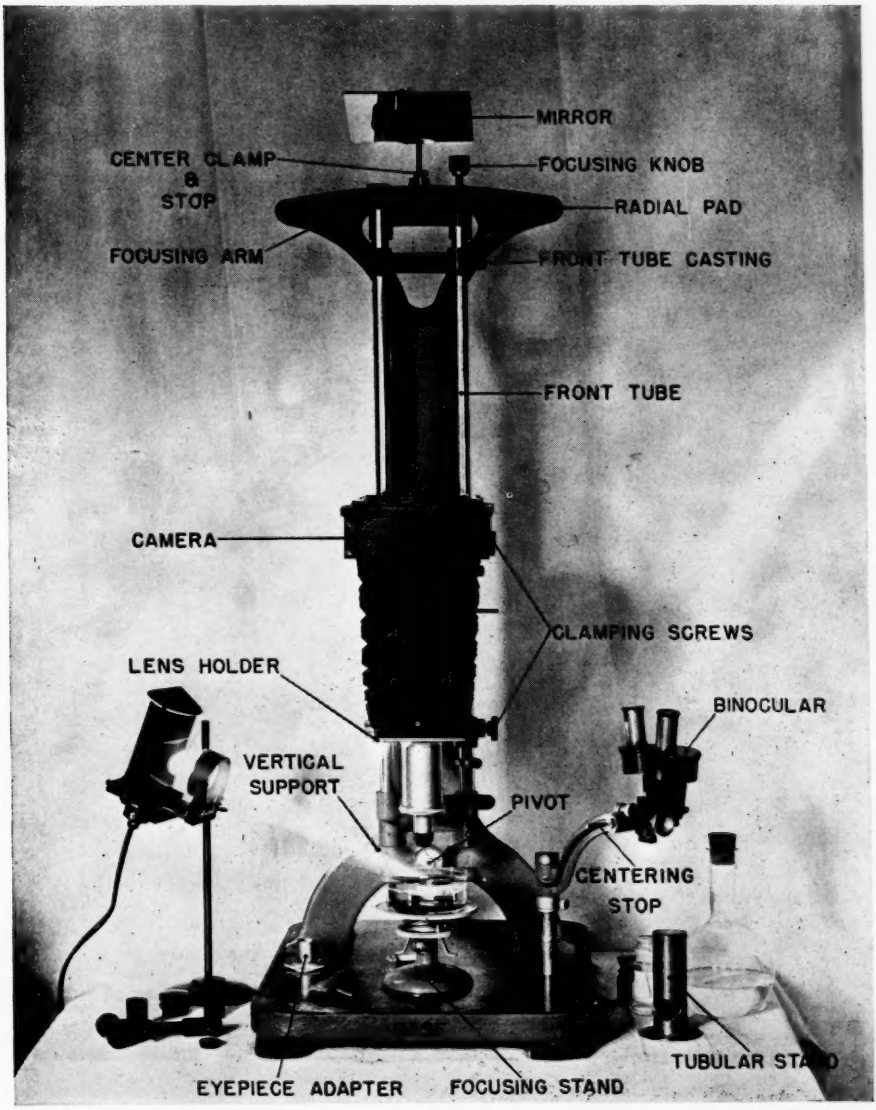


Figure 1. Front view of the assembled camera with the binocular swung aside. The cast iron base, vertical support, front tubes, with attached camera are shown. The centering stop is an adjustable pin projecting from the binocular support which positions the instrument in the optical axis of the camera. The specimen rests on the focusing stand. Several accessories, resting on the table include a tubular stand which is used to center and focus the binocular and cross hairs of this camera. This stand when placed in the optical axis is at the exact level of the pivotal plane.

tube. These pads are held against the tube by means of a slotted phosphor bronze clip. The latter is riveted to the side of this tube and the front edge of the vertical slot bears against a pin set in the opposing front tube. This arrangement allows adequate vertical movement for focusing and at the same time prevents any lateral displacement. The lifting screw is placed at the top of the right back tube which is tapped to receive it. A turned seat on the shank of the screw carries a focusing arm which is pinned to the top of the left front tube.

The "geometric slide", with clamping bar and screw, is shown in figure 2 incorporated in the lens holder. (A similar arrangement is a part of the camera plate holder element.) The clamping bar carries a knurled screw with a tapered end to fit a correspondingly figured hole in the post which is integrated with the lens holder. The latter presses against the front tubes and can be locked in any desired position with the clamping screw. For convenience in manipulation the screw is placed at the side and pressure is developed at right angle to its movement by means of a cone on the shaft and a matched hole in the post. To facilitate the accurate alignment of the lens holder adjusting and locking screws were placed in the slide element of this assembly. This made it possible to obtain exact centering of the lens holder in relation to the optical axis of the camera. Incidentally, this axis was made to agree with

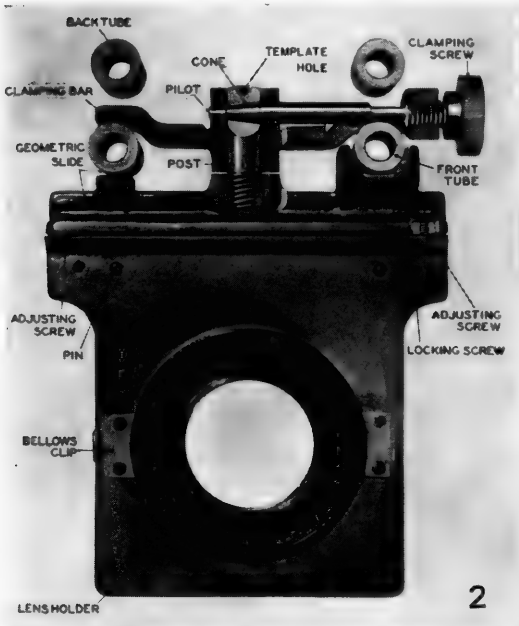
DESCRIPTION OF TEXT FIGURES

Figure 2. Plan view of the lens holder, geometric slide, clamping bar and screw with cross sections of the four tubes. The adjusting and locking screws for exact centering of the lens holder are indicated. The large hole is threaded to receive lenses or the wide tube shown screwed in position in Figs. 4 and 5. The clamping assembly is partially cut away to show how it functions. The post is permanently integrated to the lens holder and the cone of the clamping screw when advanced forces the bar and geometric slide firmly against the tubes. The circular rim shown between the clips serves as a light-tight seal for the bellows.

Figure 3. Side view with microscope and lamp arranged for photomicrography. The relationship of the two sets of tubes is shown. The lower hinge is shown encircling the right back tube which forms the pin of the hinge upon which the front assembly swings.

Figure 4. The camera tilted for photographing one view of a stereograph with wide tube assembly; with specimen posed in the stender dish on focusing stand.

Figure 5. Divided microscope arrangement with the regular tube removed from the Spencer Lens Company No. 7 stand and replaced with the wide tube of the vertical camera. The bellows was released from the clips on the lens board and raised to reveal the eyepiece adapter in position.


BACK TUBE
CONE
TEMPLATE HOLE
CLAMPING SCREW
CLAMPING BAR
PILOT
GEOMETRIC SLIDE
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ADJUSTING SCREW
PIN
LOCKING SCREW
BELLOWS CLIP
LENS HOLDER
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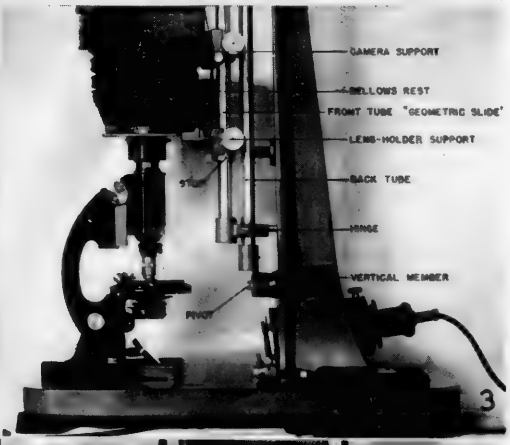
CAMERA SUPPORT
BELLOWS REST
FRONT TUBE "GEOMETRIC SLIDE"
LENS-HOLDER SUPPORT
BACK TUBE
HINGE
VERTICAL MEMBER
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LENS HOLDER
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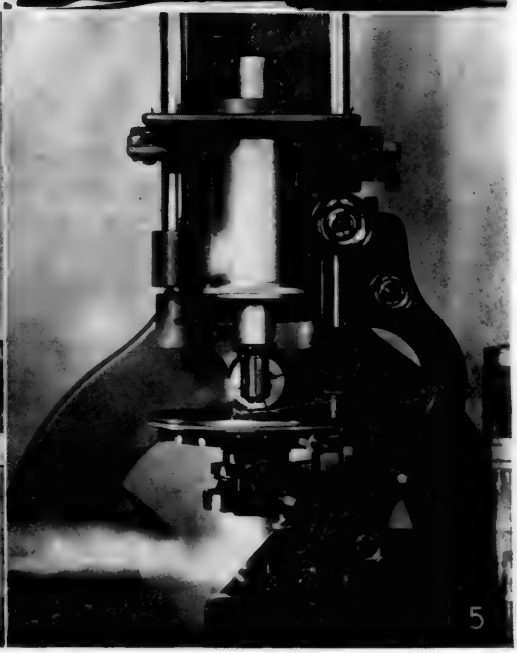
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the center of the pivot so that there would be no displacement of the image in stereoscopic work.

To permit aligning the camera elements a tubular stand with a cross hair placed at the exact center of the pivotal plane was made and is shown as part of figure 1.

The focusing specimen stand, figure 6, is of sturdy design. The base is of cast iron whereas the stage and its cam, focusing disc and tubes are of brass. The rapid adjustment tube is easily moved and held in position by the clamping screw. Fine adjustment is accomplished by a circular movement of the focusing disc upon which two pins bear on symmetrical cams beneath the stage. The key and key slot prevent the stage from rotating as it moves vertically. The method of posing small specimens under fluid, covering the container with a plate of glass and photographing through the glass and fluid, has proved successful but the weight was greater than most rack and pinion adjustable stands would support. We have found this new type of stand satisfactory.

When using the camera with Micro-Tessars and longer focus lens we have made for each lens a brass bar template with a series of holes spaced to correspond to the exact focal length of the lens for which it serves. This is not illustrated. Each lens was calibrated since we found slight discrepancies in the focal lengths listed by the manufacturers. The templates carry pins at the lower ends which fit into a hole of the lens holder post through which the clamping cone works. A smaller hole in the post of the plate-holder support receives a pin which passes through the template in use. This movable pin, which serves to position the two holders, is clipped on the template bar for the lens in use, moved to the hole corresponding to the desired magnification and allowed to enter the hole of the plate holder. The two elements thus held together as a unit can then be moved into focus either by sliding on the bars or when the clamping screws are tight by turning the focusing knob. We use six templates with a range of magnifications from ½ natural size to x 36. This does not include the wide tube photomicroscopic assembly with eyepiece, shown in figure 5.

The tube assembly (fig. 4) is similar in design to a standard wide tube microscope. The lens holder can also accommodate lenses ranging from the Bausch and Lomb Optical Company's no. 10-VII Convertible Protar (200 mm.) down to any objective with standard Royal Society thread. The bellows is detachable from the lens holder and is held above the head by a bellows support, figure 3, when microscopic observations are being carried out with the unit as shown in figure 5. This illustration

further shows how the tube and the optical elements can be separated from the stand carrying the specimen when making single views with transmitted light. It is possible to swing the binocular microscope over the stage, pose a delicate specimen with its aid and then move the

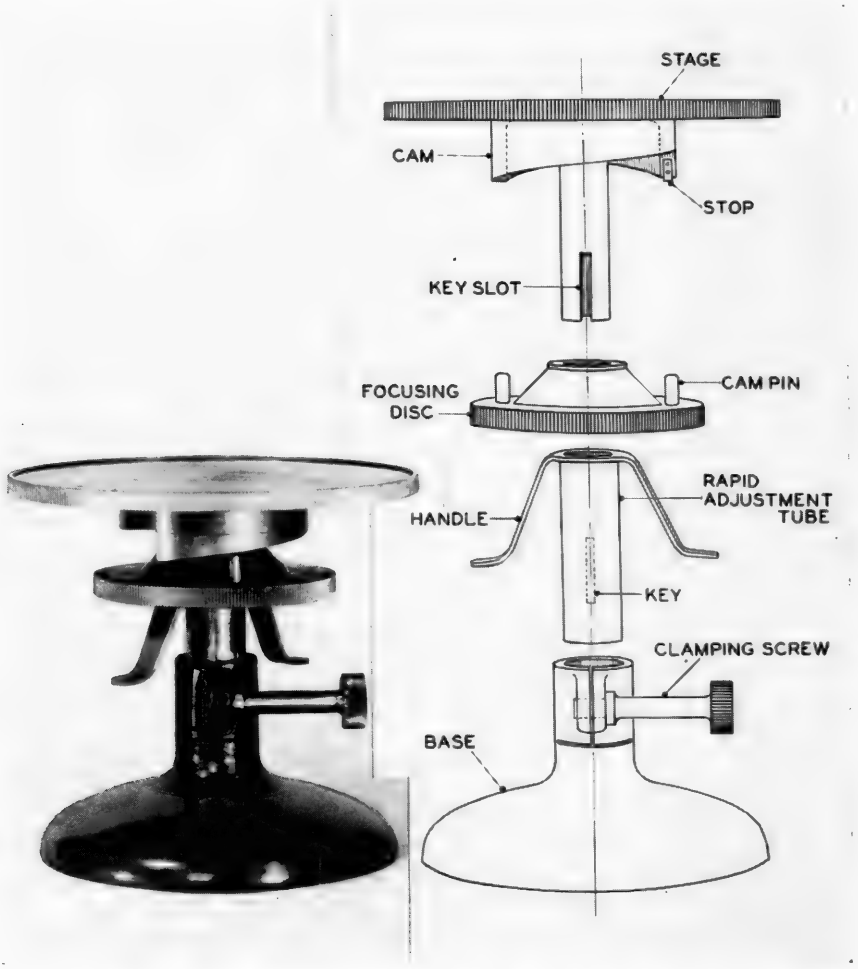

Figure 6. Focusing specimen stand. The base is of cast iron; other parts of brass. For rapid adjustment the tube is moved up or down after the clamping screw has been released. Final focusing is made by rotating the disc. The key and matching slot prevent the stage from turning.

binocular so as to allow the wide tube microscope of the vertical camera to be moved into position without disturbing the specimen. This arrangement is of the greatest convenience when an exact posing of a small object is desired.

Three vertical stands of the type described have been in use in laboratories of the Carnegie Institution of Washington since 1936. Several slight modifications have been made. A scale has been added for convenience in calibrating the camera for photomicrographic work. This has been placed between the back tubes. A bracket carrying a fiduciary line has been extended from the camera at the emulsion level to the face of the scale to facilitate accurate reading. Another attachment was a bracket to which a Leica sliding copy attachment was fastened for photomicrography with Kodachrome. One stand has had a revolving back incorporated. This stand has been in daily use, and most of the photomicrographic and gross work of the Department of Embryology has been done with its aid.

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BOOK REVIEW

WAR MEDICINE, A Symposium, by Winfield Scott Pugh, M.D., Editor, Edward Podolsky, M.D., Associate Editor, Dagobert D. Runes, PhD., Technical Editor. New York, Philosophical Library. 565 pages, cloth cover, size 6 x 9 inches. Price $7.50.

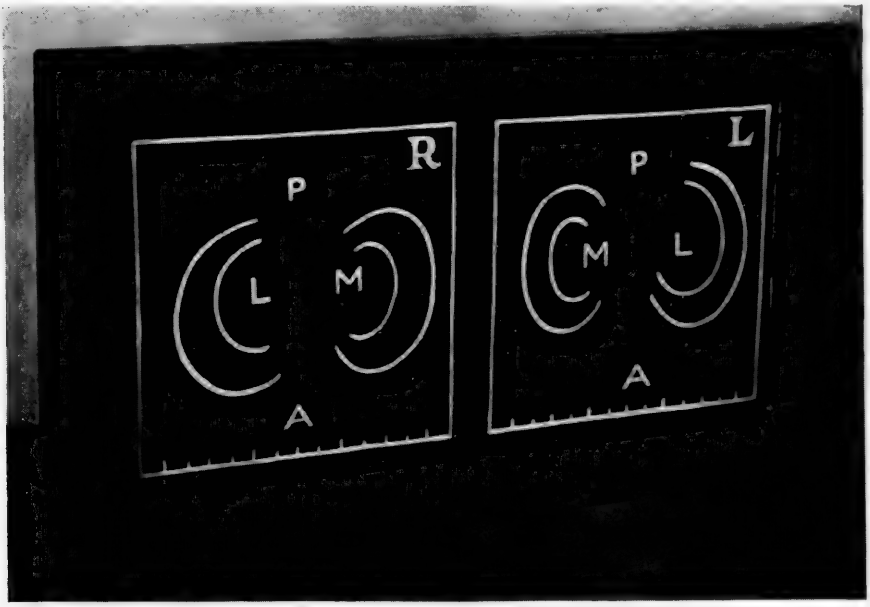
The book is divided into three sections: Surgery, Aviation and Naval Medicine, General Medicine. The section on Surgery contains thirty-three separate chapters on the treatment of wounds, fractures, shock, anaesthesia, the danger of various parts of the body in modern warfare, etc. Aviation and Naval Medicine is composed of ten chapters which include: Principles of aviation medicine, physiology, the newer cardiology, hypotension, medical aspects of deep sea diving and high altitudes, fatigue and sudden compression injuries of the abdomen at sea. General Medicine comprises fourteen chapters in which are discussed: The nutrition of the soldier, allergy, care of the feet, insect bites, malingering, and selective service psychiatry. Thirty of the sixty-six collaborators are army or naval officers; thirteen of this number are with the British Armed Forces. There are 109 figures and several tables interspersed in the text. Most of the articles are supplemented by a bibliography.

Photography of Meniscus Cartilages after Removal—Menisectory

R. J. Whitley*

THE frame consists of two diagrams indicating each knee, and marked (L) left and (R) right, respectively, L & M—(lateral and medial) P & A—(posterior and anterior).

The scale at the base shows the measurement (as shown in the photograph).



When the glass is covered and framed, it is advisable to seal the glass to the wooden frame, and prevent any moisture from the cartilages seeping through.

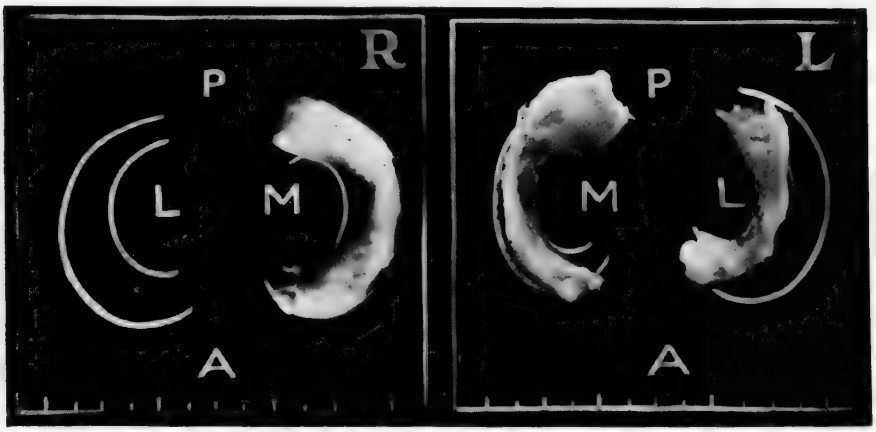
After the operation the surgeon arranges the cartilages on the ap-

* 117 Ebury St., London, S.W.1.
Received for publication July 29, 1942.

plicable frame, in the same position as it was found in the knee joint, noting natural tears, bucket handles, etc.

The photograph should be taken as soon as possible, to retain the characteristic texture of the cartilage, although immersion in saline will retard 'hardening' for some considerable time.

With the camera in a vertical position and the normal 45 illumination, the cartilage is focussed to facsimile and photographed.



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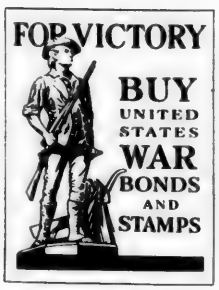

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Recording, Photographically, Flexion and Extension of an Injured Limb

by R. J. Whitley

A LINE positive is made of an ordinary celluloid protractor, to the desired size.

When printing from the negatives showing the limb in the positions of flexion and extension, the 'protractor positive' is carefully placed in position between the negative and printing paper.

By halving the camera exposure, and the patient making the full extent of movement, the effect of a double exposure can be obtained, and a more complete registration of limited movement can be recorded.

Color Photography During Surgical Procedures

Wilson Footer, M. D.*

THE photography of operative findings and procedures is valuable for the recording of such material and as an aid in the instruction of students. The present equipment was designed to permit the surgeon to accomplish this with a minimum of interference with the operation.

Apparatus

The principles upon which the apparatus was constructed are 1. a constant light source, 2. a prefocused camera and 3. both the lights and the camera used at a constant distance from the operative field. This arrangement eliminates all of the detailed and time consuming procedures such as arranging the lights, taking the light reading, focusing the camera and setting the aperture and speed.

A working distance of 2 feet was chosen because the field of approximately 10 x 15 inches is adequate for almost all cases and the lights at this distance give illumination sufficient for proper exposure of Kodachrome Type A (artificial light) film.

Two Wabash Reflector Superflood bulbs are mounted within a sheet metal box, the opening in the bottom being covered with a sheet of glass. The glass prevents any dust particles which may be moved around by the convection currents from falling into the wound and it also minimizes the hazard from possible shattering of the bulbs. It is removable so that the inside of the box may be cleaned and the bulbs replaced. The top of the box has vanes to prevent overheating but these have been found to be unnecessary because of the very short time the bulbs are in use for an exposure. Elimination of the vanes would completely shield the patient if the bulbs should shatter, which although rare must be kept in mind as a possibility.

The 35 mm. Argus Color Camera is mounted on the front of the box with the lens centered. The camera is permanently set at 1/25 second, f:4, and focused for 2 feet. The light box and camera are in turn mounted on an adjustable standard. The lights are controlled by a

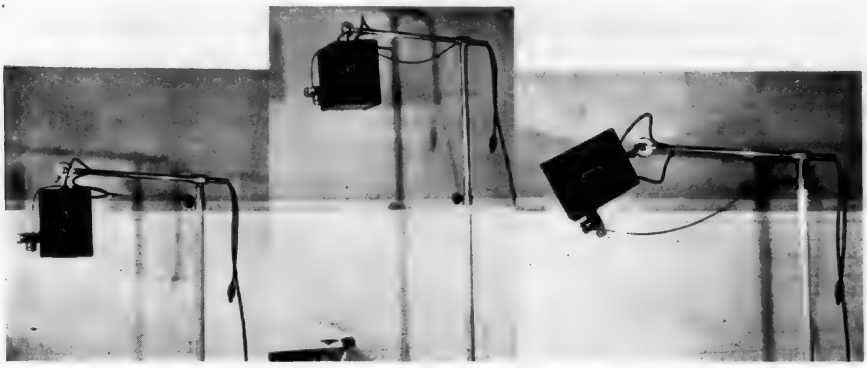
* Stanford University School of Medicine, San Francisco.
Received for publication July 24, 1942.

switch at the end of an extension cord which passes back through the horizontal tube of the standard. The lights are on only while pressure is applied to the switch, about 5 seconds for each picture. This prevents overheating of the tissues and utilizes the life of the bulbs (rated at 6 hours) to the utmost. The shutter is controlled by an extension cable release. By the use of these two extensions the unit can be controlled from a position well behind the members of the operating team.

PROCEDURE

1. With the patient on the table in the position for operation the apparatus is moved up and the camera centered so that the sheet of glass is parallel to and the lens is two feet from the contemplated field. Since the depth of focus for this lens (50 mm., f:4) used at 2 feet is from 1 foot 9½ inches to 2 feet 2½ inches or a total of 5 inches[1], allowance for this must be made when the area to be photographed is more than 2½ inches below the surface. After these adjustments have been made the apparatus may be wheeled back and the patient prepared for operation.

2. The light plug is connected with the wall socket. When a photograph is desired during the course of an operation, the apparatus is wheeled up to the table and centered anteriorly and laterally over the area. The light switch is pressed and held down with one hand while



1. Apparatus assembled. The camera protrudes at the left and the light switch and cable release are at the extreme right. The cable extends to the wall outlet.

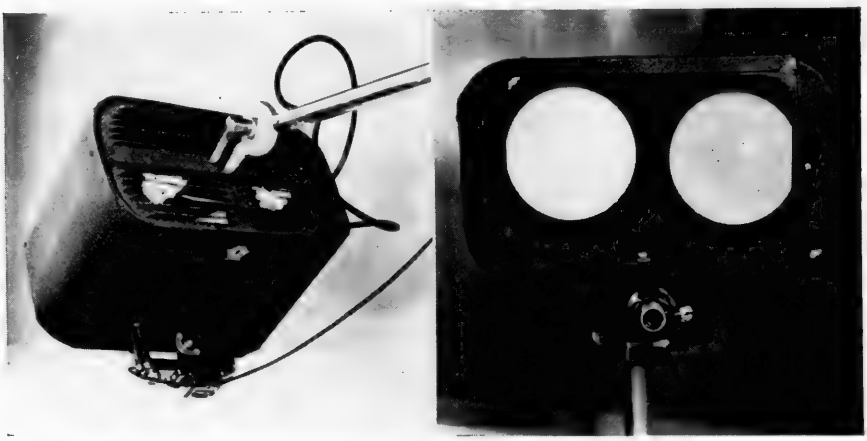
2. Apparatus elevated to extreme available height.

3. Apparatus arranged for perineal and similar photography. Note that the horizontal tube of the standard has been rotated so that the camera is now on the lower side of the light box.

[1] Argus Instruction Book.

the other presses the cable release. Pressure on both of these is released and the apparatus removed, after which the film is advanced and everything is ready for a repetition of the process.

The field to be photographed can be fairly accurately centered by sighting anteriorly and laterally except where the total area to be included in the picture is almost as large as that of the photographic field (10 x 15 inches). In the latter case it may be necessary to use a wire



4. View of the upper surface of the unit when in position shown in Fig. 3.
5. Two Wabash Reflector Superflood bulbs covered with plate of glass, removable by pressing button at right and sliding glass to right. The screw attaching the camera to the housing is behind the glass in lower center.

frame, iconometer, which is attached to and extends down 12 inches beyond the lens housing and delimits more accurately the field that will be recorded on the film[2].

A refinement which increases the efficiency by obviating the removal of the apparatus from over the operating table between pictures consists of the use of a multiple exposure camera such as the Robot. With this it is possible to make a series of exposures in rapid succession. However, this is so rarely necessary that the increased cost of the equipment will have to be justified on the grounds of convenience.

CONCLUSIONS

1. Photography of operative findings should be carried out routinely in every teaching hospital.
2. A simplified apparatus for surgical photography should be constantly available in the operating rooms.
3. An apparatus is described which facilitates the photography of surgical procedures.

[2] Pierce, L. F., A New and Simplified Technic of Surgical Photography. J. Lab. & Clin. Med., 17:81-84, Oct., 1931.

A New Method for Viewing Sheet Kodachrome*

by Albert A. Stone, R. Donald Reed, and Louis Schwartz,[1]
Medical Director, United States Public Health Service

IN the photographic unit of the National Institute of Health, hundreds of transparencies of Kodachrome professional film have been produced during the past two years. Many of these were connected with studies on dermatoses, and therefore were required to show very fine detail. These films have been mounted for lantern slide projection and light box viewing. From selected ones, wash-off relief color prints were made for permanent exhibits. Often the fine detail on the film was lost in the wash-off prints.

Since printing of Kodachrome in color is expensive and time-consuming, often entailing inexactness in color and loss of detail, it was believed that if a technique could be developed for directly mounting Kodachrome film for exhibit purposes, a worth-while economy of time and money could be effected.

Some time ago a series of Kodachrome films was exposed under varying lighting conditions, and in the study of these test films it was observed that one of the transparencies, when placed on a white sheet, made a viewable picture. While this picture was sufficiently clear to show the pathological detail, it was believed that improvement in color values could be achieved with further experiments in exposure, chemical manipulation, and modifications in the material forming the reflective background.

We have now devised a method by which Kodachrome film can be mounted into a viewable picture. This is accomplished by means of accurately controlled lighting and exposure conditions, and backing material of high light-reflective properties. A technique has been developed whereby the density of the Kodachrome film can be reduced to the density necessary for our method of viewing.

Description of Method

A fixed focus range finder is used as a means of maintaining a constant subject-camera distance.

[1] From the National Institute of Health.

* Reprinted from "Public Health Reports", October 24, 1941.

Illumination is obtained by a total of 4,000 watts of incandescent light so placed that the subject is evenly illuminated. From data previously obtained with the lens to be used, the optimum exposure for a "thin" transparency is made. In case of doubt, slight underexposure for a "thin" transparency is preferred. When the transparency is received from the developing laboratory, it is placed, emulsion down, against the glossy side of fixed-out Eastman white topographic film and observed for general effect.

If the immediate result is slightly dark, the following chemical treatment is given to the transparency: It is soaked in distilled water at 76°F. for 5 minutes. Then it is placed in a solution, 1 per cent by weight, of sodium hydrosulfite. This gradually reduces the density of the dye deposit. At periodic intervals the transparency is removed, rinsed in distilled water, placed against a white background, and checked for effect.

When the desired density is reached, the transparency is thoroughly washed in water and hung to dry. After it is dry, it is ready for mounting, as follows:

The transparency is pressed, emulsion side, to Eastman white topographic fixed-out film. This is placed between a piece of clean glass for the front and another piece of glass or flat material for the back, and bound with cellophane tape. The resultant picture gives satisfactory rendition of skin tones and detail.

Copies and enlargements can be made from this mounting with a process camera, using the factors of exposure described above for taking the original. Enlargements from small transparencies may be made onto sheet Kodachrome with proper filters and resultant transparency processed as described above.

The resulting picture shows no screen or grain, and detail can be studied with a hand magnifying lens.

A Method for Reducing the Density of Kodachromes

by Stanley J. McComb *

EVERY photographer who uses Kodachrome has desired on occasion to reduce in density or "clear" a transparency as an aid to more brilliant projection of that transparency. Stone, Reed and Schwartz[1] described a method devised by them for reducing the density of Kodachromes. They found that a chemical commonly used in the dye industry, sodium hydrosulfite ($NA_2S_2O_4$), has a reducing action on the Kodachrome dyes. While their method was for the purpose of utilizing a Kodachrome transparency as a mounted picture, to be viewed by reflected light, the principle is useful when applied to transparencies for projection.

The technic for reduction consists of soaking the Kodachrome in distilled water for five minutes, then immersing it in a 1 per cent solution by weight of sodium hydrosulfite, which gradually reduces the density of the deposit of dye. The transparency should be checked frequently and, when reduction is judged sufficient, washed thoroughly and dried.

A few observations may be of interest. A wet Kodachrome has a higher degree of transparency than a dry one, so that allowance must be made for this in judging the degree of reduction. Carry reduction to the point where the transparency is a bit lighter than you think it should be; then wash and dry.

Sodium hydrosulfite seems to have a selective reducing action on the dyes used in the Kodachrome process. It reduces first the characteristic bluish cast usually associated with underexposure. This is a slight clearing action, with no appreciable change of color balance. Too great a reduction causes a loss of magenta, which definitely does affect color balance. Because of this it is useless to attempt to reduce a "heavy" on greatly underexposed Kodachrome. However, within the limitations

* Section on Photography, Mayo Clinic, Rochester, Minn.
Received for publication July 1, 1942.

[1] Stone, A. A., Reed, R. D. and Schwartz, Louis: A new method for viewing sheet Kodachrome. Pub. Health Rep. 56:2087-2088 (Oct. 24) 1941.

observed, the method is a convenient aid in improving certain Kodachromes. Figure 1 gives an idea of the improvement possible by this method.

Fig.1. Reduction of density of Kodachromes by use of sodium hydrosulfite.

★★★

Analysis of Reports of Physical Examination*

Summary of Data from 19,923 Reports of Physical Examination

THE Selective Service System is making an analysis of the reports of physical examination for each registrant examined in accordance with the provisions of the Selective Training and Service Act of 1940. Pending the complete analysis of these reports, a survey has been made of 19,923 reports to provide an indication as to the physical fitness of American youth between the ages of 21 and 36 for military service. This sample was stratified by states for representativeness and includes a cross section of registrants examined prior to May 31, 1941.

Summary reports from local boards and a sample analysis of reports of physical examination by Selective Service local boards and Army induction stations indicate that about 50 per cent of approximately two million registrants who have been examined have been found to be unqualified for general military service by Selective Service local boards and Army induction stations because of physical, mental and educational reasons. Of the approximately one million registrants who were not qualified for general military service, 900,000 were so classified because of physical and mental defects and 100,000 because of the lack of educational qualifications.[1] Of the 900,000 rejected for physical and mental reasons, 470,000, or 23 per cent of those examined, were qualified for limited military service, and 430,000, or 22 per cent of those examined, were disqualified for military service.

Based on the present physical standards, about one million men out of approximately two million examined were qualified for any type of military service in the Army immediately, and at least 500,000, or 25 per cent, were available for the performance of military dutes in a slightly limited capacity. Thus out of the approximately two million exam-

* Prepared by 1st Lt. Oliver Harold Folk, Chief, Medical Statistics Section, Research and Statistics Division under the direction of Mr. Kenneth H. McGill, Assistant Chief, Research and Statistics Division and in cooperation with Col. Leonard George Rowntree, M. C. — Res., Chief, Medical Division.

[1] These estimates are based on classification reports from local boards as to the number qualified for limited military service, the number disqualified for any military service, and the rate of rejections by groups of defects or diseases by availability for military service as revealed in an analysis of 19,923 reports of physical examination. The major defect or disease for each registrant was determined by the principal cause of rejection.

ined, at most, 25 per cent were not qualified for any type of military service.[2]

Based on the major defect or principal cause of rejection, dental defects account for an estimated 188,000, or 20.9 per cent of the 900,000 registrants not qualified for general military service by Selective Service local boards and Army induction stations; defects of the eyes, 123,000, or 13.7 per cent; defects of diseases of the cardiovascular system, 96,000, or 10.6 per cent; musculo-skeletal defects, 61,000, or 6.8 per cent; venereal diseases, 57,000, or 6.3 per cent; mental and nervous diseases, 57,000, or 6.3 per cent; hernias, 56,000, or 6.2 per cent; defects of ears, 41,000, or 4.6 per cent; defective feet, 36,000, or 4.0 per cent; defects of lungs, including tuberculosis, 26,000, or 2.9 per cent; and miscellaneous defects, 159,000, or 17.7 per cent. Included in the miscellaneous group were defects and diseases of the mouth and gums, nose, throat, kidneys and urinary system, abdomen, genitalia, and skin, hemorrhoids, varicose veins, tumors, and infections and parasitic diseases.

Selective Service local boards classed approximately 41 per cent of all registrants physically examined as available for limited military service or disqualified for any military service. Of the 59 per cent examined by local boards and classed as available for general military service approximately 15 per cent (or 9 per cent of the total number examined by the local boards) are rejected at the Army induction stations for borderline physical or mental conditions, diseases and defects obtained since the time of the local board examination, educational deficiencies, and other miscellaneous reasons.

The President has charged the Selective Service System with the administration of a program for the physical rehabilitation of rejected men who can be completely and permanently rehabilitated at a reasonable cost in a reasonably short period of time and made available for general military service in the armed forces. Of the 900,000 who have been classed as available for limited military service or disqualified for military service, an estimated 200,000 can be completely physically rehabilitated for the performance of general military service. Perhaps one-half of those who have remediable defects, or 100,000, have dental defects that can be successfully corrected.

[2] These estimates are based on the classification reports from local boards as to the total number found unqualified for general military service at the Army induction station, and the rate of rejections by groups of defects or diseases as revealed in an analysis of 123,000 reports of physical examination at the Army induction station as released by the War Department. The major defect or disease for each registrant was determined by the principal cause of rejection.

CHATS WITH THE EDITOR

Photography—A Dyeing Art?*

PHOTOGRAPHY is facing a new development almost as far-reaching as the change from tintypes to cellulose film. In the 103 years since Louis Jacques Daguerre invented the daguerrotype the use of light-sensitive silver salts has been the basis of photography. Now silver is being replaced by coal-tar dyes. So far this new dye-treated film has been used only to make duplicates of sound tracks from regular film. But scientists believe that dye-treated film for direct photography is in sight.

In ordinary photography silver bromide, emulsified in gelatin, is spread on a transparent cellulose-acetate film, forming a photo-sensitive layer on one side. When exposed to light, the bromide becomes activated so that it is easily reduced to metallic silver by a developer. The grains of metallic silver remain as black spots after fixing, so that the image is a "negative"—darkest where the light was strongest.

In the new dye-treated film, there is no surface emulsion and no silver. Instead, a strip of cellophane is thoroughly impregnated with a mixture of "diazo" compounds which are closely related to dyes, but are only a faint yellow in color. Wherever light strikes, the diazo compounds are quickly and effectively bleached. Developing and fixing are combined in a single operation (exposure of the film to ammonia fumes), which may be done in subdued daylight. This exposure does not change the portions of the film that light has reached, but the ammonia turns the unexposed diazo compound red (or some other color, depending on the particular compound used). Result is a positive with the image on the inside instead of on the surface of the film.

For sound-track recording the contrasts are clear and sharp. Since no complicated chemical treatment is involved, the film can be exposed, developed, finished in a continuous operation at 80 feet per minute. Since the image is inside the strip not on the surface, scratches and dust are no problems. The cost of the dyed film in one-tenth that of silver, and because of its sharpness can carry three times as much sound track per inch.

* Reprinted from TIME, August 24, 1942.

CURRENT PHOTOGRAPHIC ABSTRACTS

SCATTERED LIGHT, IMAGE GRADATION, AND SURFACE-TREATED LENSES. P. C. Smethurst. "Brit. J. Phot.", 88: 427-28, 434-36, Oct. 10, 17, 1941. The author discusses the theoretical and practical effects on image gradation of surface-treated lenses. He concludes that the treatment is only worth while on lenses consisting of many components. J. L. H.

AIDS FOR ANALYZING HIGH-SPEED ACTION. E. M. Watson. "Gen. Elec. Rev.", 44: 549-57, October, 1941. An illustrated summary is given, with examples, of the various means available for analyzing actions both visually and photographically. F. P

EXPERIMENTAL RESEARCH IN AUDIO-VISUAL EDUCATION: An EVALUATION OF THE USE OF VISUAL AIDS IN THE TEACHING OF BIOLOGY. D. Goodman. "Educational Screen", 21: 70-1, February, 1942. An investigation carried out by C. A. Cate, at the high school at New London, Texas, is described. Three groups were studied. One group used no mechanical visual aid, although the usual museum pieces, flat pictures, etc., were used; a second group used these, plus lantern slides, projectors, and micro-projectors for microscope slides; and the third group added motion pictures, both sound and silent. The students of the full-visual aids group showed a gain of 18.4 per cent over the students of the nonvisual aids group, and a gain of 15.8 per cent over those of the partial-visual aids group. The attention of the full-visual aids group was 19 per cent higher than that of the nonvisual aids group and 10 per cent higher than that of the partial-visual aids group. Students of the nonvisual aids group were absent twice as much as those of the full-visual aids group. R. P. L.

TESTING SHUTTER SPEEDS AND FLASH SYNCHRONIZATION. J. A. Bledsoe. "American Photography", 36: 36-8, January, 1942. A device consisting of a cylinder covered with a sheet of sensitized paper revolving behind two slits is mounted in place of the ground-glass back on a view camera. One slit permits light from a flash bulb to make a

record of the entire flash on the paper; the other slit admits only light from the bulb which passes through the shutter to be tested. From the relative position and length of the two records, the degree of synchronization of the shutter and lamp, the speed of the shutter, and the duration of the flash can be determined.

WHAT DOES "COLOR TEMPERATURE" MEAN TO YOUR KODACHROME? G. J. Folsey. "Amer. Cinematographer", 22: 527, 543-44, November, 1941. An explanation is given of "color temperature" as it affects the results obtained using Kodachrome. The use of a meter for measuring color temperature is suggested when the properties of the light source are unknown. C. J. K.

CONVERTING GLOSSY PRINTS TO ROUGH SEMI-MATTE. R. Southey. "Brit. J. Phot.", 89: 30-1, January 23, 1942. By sandwiching the print and glass (or emery paper) together under pressure, the surface of the gelatin is indented and the glossy print made semi-matte. R. S. S.

PRINT LACQUERING. D. D. Nibbelink. "Photo Technique", 3: 34-6, December, 1941. The technique of lacquering prints on rough textured papers is explained. A great increase in the tonal range of the print results from this procedure. C. J. K.

REFLECTION COPYING. S. C. Duty. "J. Documentary Reproduction", 4: 177-82, September, 1941. The construction and operation of an inexpensive, readily portable, and easily made piece of equipment for reflection copying is described. The apparatus is of special value when only a few pages from different books are to be copied from time to time. No camera is required, and the work may be carried out in a room having only the usual amount of illumination. M. W. F.

PHOTOGRAPHIC SHORT CUT IN MAKING LABORATORY RECORDS. S. G. Taylor. "Electronics", 15: 64, 66, 68, 70, February, 1942. The author describes his technique for quickly making permanent records of laboratory data by photographing them directly onto paper, such as Eastman Kodabromide No. 1. W. K. G.

TECHNIQUE FOR ULTRA-CLOSE-UPS. J. W. McFarlane. "Photo Technique", 3: 22-5, December, 1941. The construction and use of a wire frame attached to the camera support for the purpose of indicating the exact focal distance and the extent of the field in extreme close-up work is described. The use of a supplementary lens for such work is also mentioned and the general laws relating to magnification, depth of field, aperture, and lens diameter are explained. C. J. K.

BLACK AND WHITE'S FROM KODACHROME. A. B. Walker Jr. "Photo Technique", 3: 40-1, October, 1941. When a suitable 35-mm. camera is used for making black-and-white copies from a large number of Kodachrome transparencies, it is unnecessary to take the slides apart. Dust specks are less troublesome than when the contact method is used because the original can be inspected up to the moment of exposure. Economy of film is also an important advantage of this method. C. J. K.

WANT TO BE AN ARMY PHOTOGRAPHER? J. Drew. "Pop. Photography", 9: 24-5, 90, November, 1941. Both still and motion picture ground photography are handled largely by the Signal Corps, the Air Corps having its own photographic section. A complete outline of the personnel organization of a typical Signal Corps Photographic Company is given, together with a description of the duties performed by each of the six types of units and the specific qualifications necessary for each. M. W. F.

DARKROOM ILLUMINATION. "Agfa Diamond", 5: 7-9, No. 6, November-December, 1941. The best light for darkroom illumination providing the greatest degree of visibility with the utmost assurance of safety is discussed. The effect of spectral sensitivity on the choice of the quality and quantity of light permissible is included. Outlines are given for two testing procedures for determining the safeness of darkroom illumination. M. W. F.

THE STATUS OF COLOR PHOTOGRAPHY. K. Henney. "J. Phot. Soc. Amer.", 7: 119, 121-22, October, 1941. A summary of present-day transparency and printing processes is given. Transparencies, exposure meters, color temperature, color printing media, character of the positives, and requirements for color-separation negatives are the topics discussed. G. T. E.

COPYING KODACHROME. M. Colman. "Photo Technique", 3: 30-3, 48, October, 1941. A small copying bench equipped with a repeating-back camera intended for copying 35-mm. Kodachrome is described. Although exact reproduction of all colors is not possible, masking and color compensation usually permit a satisfactory match with the original. General instructions for exposure and for masking are given. C. J. K.

News From the Trade

News from Agfa Ansco:

Agfa Ansco announces new Photoelectric Densitometer — A new instrument for measuring photographic density, the Ansco Sweet Densitometer, developed by Mr. Monroe H. Sweet of the Agfa Ansco Research Laboratories, has recently been put on the market.

This new densitometer presents many striking advantages over previous methods of density measurement used in laboratories and testing departments. The readings can be made rapidly by even inexperienced operators, with a high degree of accuracy, and with a minimum of visual fatigue.

The basis of Mr. Sweet's instrument is in the use of a photo-sensitive tube which, when placed in the path of a beam of light, varies the flow of an electric current in proportion to the intensity of the light. This current, after amplification, actuates a meter which is calibrated directly in terms of density. There are many problems involved in arriving at an electronic circuit which is stable over long periods of time, and which has a response such as to permit uniform calibration of the meter scale directly in terms of density. Mr. Sweet's unique circuit gives the new densitometer these important characteristics, in addition to its other advantages of ease and accuracy of operation.

Complete technical specifications and price quotations will be furnished by Agfa Ansco, Binghamton, New York, upon request. The sale of the instrument is subject to priority regulations.

Two New Defense Films announced — In view of the fact that defense industries are finding an increasingly wide number of uses for industrial x-ray films, Agfa Ansco has designed two new films — Superay "A" and Superay "B" — that have unique radiographic characteristics.

Because of their extreme contrast and fine grain, it is possible with these new films to record minute defects that have escaped detection by films generally used for x-ray inspection in the past. Requiring slightly longer exposure than "A," Superay "B" now enables industry to record and study detail within a structure of metal or other material in a manner that would remain impossible, were it not for the unique characteristics of this newest material for non-destructive radiographic testing. Particularly interesting is the adaptability of both Superay "A" and Superay "B" to give optimum results when used with million-volt

and radium exposures as well as low-voltage exposures for raying aluminum and magnesium alloys.

Requests for further information on these new films should be sent directly to the Product Information Department, Agfa Ansco, Binghamton, New York.

News from Leitz:

Leitz has made available a new type of Lens Opening Cover. This item is used to cover the lens opening in the Leica whenever a lens is not screwed into the camera. Many photographers have more than one Leica and use their lens, or lenses, interchangeably on the Leicas. A Lens Opening Cover is a necessity to them to prevent dust and dirt from entering the camera when it does not have a lens on it.

Formerly, the Lens Opening Cover was made from aluminum. The new type, made of the "non-essential" materials, serves the purpose just as well, and it has been possible to make it available at a lower price than the former type. E. Leitz, Inc. state that, wherever possible, they will strive to utilize "non-essential" materials to make various items available to photographers.

F. R. HARDING,
Children's Hospital,
Boston, Mass.

In Memoriam

E. H. Anthes, manager of the New York Branch of the Bausch & Lomb Optical Company since 1933, died on August 3, 1942, following a short illness. He had been associated with the company for 33 years. Prior to coming to the United States he was associate manager of the London Office. He was widely known in educational and industrial circles as an authority on the use and history of the microscope.

From the time of its first meeting Mr. Anthes has given the Biological Photographic Association whole hearted support in every possible way besides being most helpful to our members by giving them the benefit of his vast technical knowledge and experience. In him this Association has lost a staunch friend whom we shall greatly miss.

Association News

EXHIBIT AT THE A.M.A. CONVENTION

The work contributed by our members for our A.M.A. exhibit was of good quality throughout. We used all of it, either on wall-panels or in albums. The black-and-white prints were grouped according to subject matter; a panel of gross specimens, of photomicrographs, of apparatus and procedures, of patients, and of experimental animals. We had one panel of color prints, and a viewing box of color transparencies, 8 x 10 in. and 3¼ x 4 in. The name of the photographer and his institution appeared with every picture.

The official photograph of the booth shows a calm and deserted scene. This is not strange, as the picture was taken in the dead of night. Daytimes, our booth was a cheerful melee of visitors, looking, talking and listening; also of members meeting or trying to locate one another. The visitors' questions centered mainly around equipment. "What do I need to start taking color pictures in our tumor clinic?" "I have this-and-that camera. How do I rig it up for cervix-pictures?" "What camera do you use for getting pictures of blood like the one you have here?" There were many questions on photomicrography, endoscopic photography and a particular interest, it seemed, in photography of the cervix. Some less ambitious visitors merely wanted to know where they could obtain ready-made pictures of certain types. Apparently a number of doctors would like to buy sets of teaching slides. But aside from a few groups prepared by medical societies, such as the American Heart Association, we know of no such slides on the market.

We answered all the questions we could, at the same time seeking some information ourselves. For instance, a list was made of all our visitors most interested in photography, usually with notes on the particular field of each. This is the sort of data we are anxious to get for our files. We were also able to discuss the preparation of exhibits with other exhibitors; the problems of medical artists in comparison to our own; and particularly the uses of photography in the emergency. Our Association was represented at the meeting called by the Scientific Exhibit Committee of the A.M.A. to discuss the production and distribution of films for medical teaching. A preliminary committee was appointed, with one of our members, Dr. Edmond Farris of the Wister

Institute, as Chairman. Reports of its progress will appear in this Journal from time to time.

A welcome number of members appeared during the Convention week. Some of the doctors who introduced themselves proved to be members we had previously known by correspondence only. As to our professional photographers, Mr. Schmidt came for the first half of the week, and at times assisted in the booth. Mr. Julin was present from the Mayo Clinic, and Mr. Massopust from Marquette University. Lieutenant Ralph Creer, now at the War Department's Army Medical Museum, was in and out of the booth gathering messages from the numerous people who were trying to contact him. Mr. Eddy came from the Eloise Hospital, Mich., with an exhibit. Ensign Sturgis, of the U. S. Naval Medical School in Washington, was another busy member who put in periodical appearances to pick up messages. Mr. Lewis Waters was present with exhibits from Baylor University, and Mr. Lester Bergman came on from New York City to supervise several exhibits prepared for doctors by his firm. Dr. John Fallon held his second exhibit of surgical photography. Miss Shiras and Mr. A. Levin both from Pittsburgh had charge of the B.P.A. exhibit. Dr. Oscar Richards came with the Spencer Lens contingent, exhibiting in the Technical Section, and Mr. Charles Brownell was there with the Eastman Kodak Co. Mr. Joseph Hackel was also present in the Technical Section with his Medical Film Guild. All in all, when a group of us met in impromptu fashion and went to Hackney's for a shore dinner, the long table of friendly faces and congenial talk make us feel as though our own Convention had somehow moved itself forward to June.

A.M.A. AWARDS WON BY OUR MEMBERS

We are proud to announce that the Gold Medal in Group 1 (for exhibits of individual investigation, judged on the basis of originality and excellence of presentation) was awarded to Dr. Eben J. Carey and Leo C. Massopust, Marquette University Medical School for an exhibit on Experimental Ameboid Motion of Motor End Plates.

The exhibit of Mr. Joseph M. Hill, E. E. Muirhead and Lewis Waters, Baylor University Hospital, Dallas, Texas, on Shock Therapy won Honorable Mention in this group.

In Group 2 (exhibits which do not exemplify purely experimental studies and which are judged on the basis of excellence of presentation and correlation of facts) Honorable Mention was won by Thomas N.

Horan and C. Graham Eddy, Eloise Hospital and Harper Hospital, Detroit, for their exhibit on Laparoscopy: Intra-Abdominal Photography in Color.

Science News Letter, June 20, 1942, published an article on Dr. Carey's and Mr. Massopust's medal-winning exhibit, in which the following paragraphs appeared:

> "Fundamental attack on infantile paralysis and other paralytic diseases and on those ailments like myasthenia in which the patients cannot move their muscles may result from experiments by Dr. Eben J. Carey and Leo C. Massopust, of Marquette University School of Medicine, Milwaukee, which have won the American Medical Association's gold medal."
>
> "These scientists showed what is probably the best microscopic picture ever taken of the motor nerve end plate, that is, the very end of a muscle-moving nerve at its point of attachment to the muscle fiber it stimulates to contract. The picture, revealing to doctors details which the textbooks said existed but which few doctors or medical students ever could see, was taken of the tiny motor end plate of the muscle between the ribs of a white rat."

For an illustrated article on the structural variations of moter end plates by Dr. Carey, Mr. Massopust and Mr. Haushalter, see the Journal of the Biological Photographic Association, Vol. 10, No. 4, June, 1942.

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B.P.A. MEMBERS IN THE SERVICE

Many of our members are now in one branch or another of the service. We wish we could give you a complete list, but that is impossible as we have not the necessary information. In several cases for instance we have had letters from members saying "I expect to leave for the Army in about a month", but as yet the details about the branch of the service, etc. have not come through.

However, we can offer a list from time to time of those about whom we happen to know, hoping to fill in the gaps as fuller information comes from various members. Here are a few members about whom we have heard recently.

Dr. Melvin Dillman of Philadelphia, Pa., former Director of the Association and president of the Philadelphia Chapter, is now a major, 38th General Hospital. The Biological Photographic Unit founded at Jefferson Hospital by Dr. Dillman carries on under the supervision of Mr. Allen Hancock.

Major Arthur Fuchs (formerly of the Eastman Kodak Co. and a

member of the editorial board of our Journal) is in the X-Ray School at Walter Reed Hospital.

Arthur C. Hurt, Jr., Los Angeles, Cal., is a Captain, stationed with the Western Defense Command and 4th Army, Presidio of San Francisco, Cal.

Lieut. Ralph Creer, Army Medical Museum, has two B.P.A. members with him in his work of activating the Museum and Medical Arts Service: Privates Howard Francis, Reading, Pa., and Howard Lawson, Brooklyn, N. Y.

Herbert Holmes, a Canadian member is now Cpl. Holmes of the R.C.A.F. Station Hospital, Dartmouth, Nova Scotia.

Henry J. Hacker's last letter bore the letterhead Fleet Air Photo NAS, Pearl Harbor, T.H.

Dr. Milo Harris, of Spokane, Washington, is now at the Naval Air Station, Seattle, Washington.

One of our directors, Mr. John Bledsoe of Cincinnati, left his photographic work in the College of Medicine to enter radio research work, but we have had no further definite information.

An inquiry as to how the Philadelphia Chapter was weathering the emergency brought the following news from its Secretary, Mr. R. G. Burton: "Dr. Dillman and nine other regular members are serving in the Army. Five of the members are doing research work in governmental capacity. Four men are in defense industries and the balance of us are either doing work in defense groups or finding it difficult to find time for anything except work." That about sums it up—most Chapters are going through the same thing, and most individuals are in one of the categories mentioned by Mr. Burton. Yet the exchange of ideas is as important now as ever—perhaps it is more important—so though time is at a premium and personnels are reduced, organizations which, like our own, encourage the spread of knowledge must be kept going and rendered as useful as possible in every way by those of us who are still at home to do it.

B.P.A. FACTS AND FIGURES

The present Journal number begins a new Volume. A few facts about the Association might be of interest to summarize our status as the new year opens. The membership changes from week-to-week, but at the close of the fiscal year 1941-42, we had 330 members, 21% of them live in New York State; 13% in Pennsylvania (of which 7%

belong to the Pittsburgh Chapter). Illinois, which two years ago had only 4% of our members now has 8% and ranks as the third most populated state—a tribute to their recently-formed chapter. Membership on the West coast is steadily increasing, and, in spite of the lack of any organized chapters, accounts for 7% of our present membership.

Professionally our members could be classified as follows:

Professional Scientific Photographers (mostly in photographic departments in scientific institutions) ---------- 26%
Free lance and Commercial Photographers (Professionals with scientific leanings) ---------- 6%
Members in the Medical Sciences (Doctors and their assistants, discounting full-time photographers) ---------- 46%
Members in the Biological Sciences (Biology, Zoology, Botany, Entomology, etc.) ---------- 14%
Members in the Photographic Industries ---------- 5%
Amateurs ---------- 3%

What trends do these figures show? A 6% increase over the number of professional scientific photographers in our last census, published March, 1940 (Vol. 8, No. 3, p. 149). And a corresponding decrease in the free-lance and commercial photographers who lean toward scientific work. The other categories show relatively little change. Our percentage of women members remains constant, contrary to all tradition about woman's fickleness. We had 14% feminine members in 1940, we have 14% today!

NEW MEMBERS

We take pleasure in announcing the following new members:

Abbott—Dr. A. C.
127 Grenfell Boulevard
Winnipeg, Canada

Baker—Dr. E. C.
Youngstown Hospital Ass'n
Youngstown, Ohio

Brenner—Beatrice — Lester V. Bergman (2)
180 Riverside Drive
New York, N.Y.

Burd—C. Rolland
1034 W. Liberty Street
Ann Arbor, Mich.

Clemeau—Marshall — George W. Reis
6356 Greenwood Avenue
Chicago, Illinois

Close—Amy E. — Louis Schmidt (23)
5 Prospect Place
New York, N.Y.

Cordish—Ruth — Agnes Roberge
938 Brooks Lane
Baltimore, Md.

Einsel—Dr. I. H.
7016 Euclid Avenue
Cleveland, Ohio

Enright—Rev. Regis, C.P. — Dr. James Reyniers
Box 171
Notre Dame, Indiana

Falck—Anna Mary H., M.T.
504 State Street
Lancaster, Pa.

Fisher—Dr. O. O.
528 E. Grand Blvd.
Detroit, Mich.

Flanagan—Kitty
3413 W. Franklin
Richmond, Va.

Giles—George H.
531 Granville Street
Vancouver, B.C., Canada

Glaser—Jane K. — Dr. James Reyniers (2)
Merck Institute of
Therapeutic Research
141 Lincoln Avenue
Rahway, N.J.

Hancock—Allen
Biological Photo Unit
Jefferson Hospital
Philadelphia, Pa.

Hapke—A. G. — George Reis (2)
American Hospital
Irving Park Blvd.
Chicago, Ill.

Harding—Harry — Avis Gregersen
Office of Visual Medical Education
Northwestern Univ. Medical School
303 E. Chicago Ave., Chicago, Ill.

Harvey—Dr. Joseph L.
222 Ledgeside Avenue
Waterbury, Conn.

Holmes—L.A.C. Herbert — Louis Schmidt (24)
c/o M.O. R.C.A.F. Station Hospital
Dartmouth, Nova Scotia, Canada

Kaplan—Dr. Emanuel
2200 Powell Avenue
New York, N.Y.

Kearney—Dr. H. L.
1403 Delachaise St.
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LEO C. MASSOPUST,
EDITOR

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Penetrating Nature's Camouflage By Introducing Contrasts

by H. L. Gibson*

THE topic of this paper is not the type of contrast of which we are all occasionally guilty when we forget a batch of negatives simmering in the developing tank; rather it is concerned with the type of contrasts in tone, sharpness, texture, and color which the camoufluer tries to eliminate in hiding military impedimenta from enemy cameras—only, we are going to consider introducing, instead of eliminating, these contrasts into our subjects.

All subjects require the presence of at least one of the various types of contrasts, to some degree, in order to be delineated photographically or even to be seen. The photography of small animals against general habitat backgrounds[1] into which they have been blended by nature, necessitates introducing one or more contrast to a high degree. For example, a green cicada amongst green leaves is not too easily seen—that is why there are hosts of cicadas still alive. Yet, as shown by figure 1, it can be photographed satisfactorily—and simply too, for this picture was made indoors with the light of two photoflood lamps. A discussion of the contrasts involved should prove useful in demonstrating the general aspects of recognizing and employing them.

Facility in the art of partially undoing what nature has done comes with practice; and practice in nature photography is excellent training in understanding photographic delineation as applied to *any* subject.

Tone Contrasts

The first tone contrast perceived by animal organisms was the difference between night and day. As Nature progressed in the science of equiping her children with optical devices for perception, animals began to see each other's tones and forms contrasted against those of their surroundings. Adaptive coloration in its cryptic (or conceal-

* From Eastman Kodak Company, Rochester, New York.
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[1] The considerations for photographically demonstrating adaptive coloration specifically are another matter and are not dealt with here.

ment) form was the natural course of the hunted, and, for that matter, of the hunter.

Examples of purely tonal adaptive coloration exists in many surface-swimming, deep-water fishes, (tuna, mackerel). Dorsally they are dark toned so that they cannot be easily perceived against the ocean depths by enemys above them; ventrally they are light toned so that they are difficult to perceive against sky-lit water by attackers below. Laterally they exhibit countershading (so common in the animal world), which blends their brightly illuminated backs with their shadowed bellies, thus producing an unmodelled, two-dimensional, form that is easy to merge into evenly toned backgrounds of habitat density.

Now, a photographer aspiring to clearly depict one of these fishes in its natural state would have to depart from nature to the extent of introducing tone contrast between the subject and its background. This could be done by utilizing a tank with a light toned bottom for depicting dorsal aspects, or, for side views, with a rear wall of suitable reflection density. Modelling* could be obtained by supplementary illumination from below to weaken the shadow from a natural top-lighting.

Introducing tone contrasts is not always as simple as it would be in photographing these fish, because most animals have a more complicated form. In figure 1, it will be noticed that the lighting was arranged at the left end of the cicada at such a height that the shadowed part of the twig came behind the light portions of the insect's legs and proboscis, while the dark sections of these appendages were contrasted against the brightly-lit section of the twig. Since the direction of the illumination was at a considerable angle from the camera-subject axis, there was enough cross-lighting to produce an arrangement of brightly lit body parts and shadowed areas that reveals the form of the subject (modelling).

The immediate background of the insect was, in this instance, held to a tone value approximating that of the specimen (for a reason to be given subsequently). However, it is usually preferable to place a dark subject against a light background and a light one against a dark area. To lighten the background in figure 1 and still maintain the habitat, the leaf behind the insect could have been tilted until its surface reflected the light source specularly into the camera lens; to

* It should be appreciated that a given tone recorded in a photograph is the result of both the reflection-density of the subject and the illumination it receives.

darken the background a shadow from another leaf could have been cast across it. Another valuable artifice consists of casting a shadow of the subject itself adjacent to a light-toned part of its body.

In photographing many subjects, small glass or tin-foil mirrors are useful for directing narrow beams of light into strategic areas, or for producing shadows from the specimen.

Sharpness Contrast

The elimination of tone contrasts as a means for cryptic coloration is only valuable under fairly rigorous conditions in the background-tone, such as those present in weed-free water or sandy deserts. In most habitats there would be danger of at least an outline of the animal involved being apparent were this the only camouflage present. Hence, the minimizing of tone contrasts in nature has been supplemented with other artifices. For example, the eggs of terns match the tones of the stones in which they are laid. This is not accomplished by an even spread of color over the shells, but rather by means of variegated splotches which appear to blend into the tone of the rocks by virtue of the same phenomenon that merges the half-tone dots in a printed illustration. (A lower incidence of dots at the small end effects some measure of countershading.) Two advantages result from the dot pattern. First, at close range the eggs look quite like pebbles with imbedded mineral specks. Second, occasional large splotches tend to break up the outline of the eggs so that their symmetry (just a little too perfect for pebbles) is minimized.

These two concealment devices—simulation of background pattern and disruption of outline—are most common and certainly effective. Yet the photographer has a simple means of circumventing them; he can introduce sharpness contrasts in his photographs.

It will be observed in figure 1, that the insect is much sharper than the leaf behind it. It is this fact that makes the cicada so noticeable, even though the tone contrast was purposely minimized. Were this leaf equally as sharp as the subject the leaf texture would merge confusingly with the body texture of the insect. It is possible to pick out, even in the blurred leaf pattern, markings that are similar to those on the bug which simulate sunny highlights on a "quilted" leaf.

The rule to follow in differential focussing is: stop down the lens to provide adequate depth of field for the subject; then locate the background far enough behind to be slightly out of focus. (Of course,

in habitat studies, the background should not be so far out of focus that its character is lost).

TEXTURE CONTRASTS

Animals simulate the texture of their surroundings in two ways: by actually adopting it, like the gravelly-backed horned "toad"; or by wearing a mimicing pattern, like many bark-hunting moths. In the first instance the photographer had best rely on introducing some other contrast. In the second, he can minimize the texture of the background by soft, front, lighting and thus show up the deception of the animal.

In cases where depicting the texture of the subject is of more significance than exact presentation of habitat, or where the natural surroundings are not too well copied in texture by the subject (you can't fool predators or photographers all of the time), then the set-up should be strongly cross lighted so that whatever difference exists can be emphasized.

Dissimilar textures should be collocated whenever possible to provide maximum differentiation—coarse textures with fine ones or matte backgrounds with glossy subjects and vice versa. In figure 1, the near wing-tip and the leaf on which it was rested for demonstration purposes are of about the same general tone and equally sharp, yet they are clearly differentiated by the texture contrast. In this instance the difference is one of coarseness. Notice also that the "hairy" texture of the twig helps to separate it from the insect at the close viewpoint adopted.

In photography there is another texture consideration that deals not so much with delineation as with distraction from the centre of interest. Whenever possible, the subject, rather than its surroundings, should exhibit the more noticeable texture. Nothing detracts from the value of a picture quite so much as a strongly patterned or blotchy background. For example, many an otherwise perfect Kodachrome transparency of flowers has been marred by a spotty conglomeration of foliage in the background—the flowers appear to be materializing out of the bubbling ectoplasm of a nightmare in Technicolor. The solution lies in eliminating strongly patterned or highlighted objects from the surroundings, leaving or introducing only those which provide a fairly even tone.

COLOR CONTRASTS

Were it practical to reproduce here the colors of a Kodachrome transparency of this cicada set up, it would be seen how recording the

subtle color contrast augments those already present and adds to the clarity of the rendition.

It is for depicting subtle color differences that color photography is so valuable, because few animals exactly match the color of all their surroundings, and in many instances slight color differences alone reveal various similar species. The use of filters is sometimes advantageous in black-and-white photography.

There is another occasion when the introduction of color contrast is necessary. Many animals have added a warning note to their vestment. These aposematic uniforms advertise: poisonous secretions—yellow hind parts of the pickerel frog; unpleasant taste—spotted red elytra of the ladybug; poisonous bite—pink spots of gila monster; "poison gas"—white stripes of skunk. The almost universal method of *attracting* attention involves the employment of bright, vivid, colors; yellow, red, pink, white. Without color photography these characteristics would often be hard to depict, particularly where aposematic colors only are held in reserve by the animal for the occasions on which cryptic coloration fails. For example, a pickerel frog would appear quite similar to a leopard frog in any black-and-white photograph, and the black-and-white rendering of a gila monster would be quite cryptic.

Figure 2 is a posed example of color contrast. Here there are none of the other contrasts discussed. The subject happens to be a spider placed on a sumach blossom. Tones, textures, and focal planes cannot help but merge in set-ups similar to this. Color contrasts can be used, however, to distinguish the subject. In black-and-white photography this can usually be done by means of filters. Figure 3 shows how the black spider has been emphasized to some extent, by using a red contrast filter (Wratten A) to lighten the red of the sumach florlets. Since the use of contrast filters affects the true rendition, it is usually better to attempt to print the subject faithfully and to obtain contrast by modifying the background.

Of course, a Kodachrome transparency would depict the color contrast strikingly in this example. The fangs of this spider are a brilliant metallic green, a fact that is lost in both black-and-white illustrations. Hence, color photography is particularly valuable in recording colored markings on the subject itself.

When color contrast cannot be attained, it is necessary, even in color photography, to introduce at least one of the other contrasts. The most beautifully clear rendition of nature subjects are obtained by

utilizing all four contrasts. To emphasize this consider an example of a subject *devoid* of all contrasts: a ladybug on a warty and spotted red apple on a hazy day. Your only recourse, in making a photograph of her, would be to entitle the result: "Cherchez la femme"!

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Copying a Full Mouth Series of Intra-Oral Radiographs

by William F. Payne*

PERHAPS one of the most difficult copies to make for a half tone reproduction is that of a full mouth set of intra-oral x-ray films. Upon examining a series of these films, one can readily see the great differences in densities. The central incisors may be perfectly exposed but the bicuspids and molars are either over-exposed or under-exposed. The most likely cause for this is, that the original x-rays were not accurately timed. Obviously this will show in the half tone reproduction. Hence something must be done to correct this over-exposure and under-exposure in the same picture. Again, due to the reduction in size of the copy necessary to fit into the modern journals a substantial part of the detail is lost.

For some time we have worked on a simple method whereby one could copy a series of dental x-rays and balance any set so that the resulting print would show an even exposure for each intra-oral film. The first step was to obtain a diffusing medium which could be used to hold back the transmitted light. Ground glass and flashed opal glass were tried but they proved impractical. Finally, traceolene was used and this proved to be ideal. Traceolene resembles ground glass in texture, but unlike ground glass is flexible. Its advantage over tracing cloth is the fact that tracing cloth will discolor with age and the bluish color of the cloth will vary. Experiments have proven traceolene much more stable.

To guage the densities of each individual film a Weston light meter, Model No. 715, was used. This meter has a baffle attached which allows the reading of light intensities of a lesser degree than can be recorded with the other types of meters. The first step in copying a series of films is to determine, with the meter, which of the individual films is the densest. This can be readily ascertained. After the densest film has been selected, the next step is to find out what is to be added

* From the State Institute for the Study of Malignant Diseases, Buffalo, New York. Burton T. Simpson, M.D., Director.
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to the balance of the films so that each one will compare in density with the densest film in the series.

A wedge of traceolene was made consisting of various thicknesses from one to ten. The wedge was 2″ x 22″. The degree of density was so slight from one thickness to two thicknesses, that it was not possible to show this difference photographically so a drawing, Figure I, will illustrate this wedge. The wedge was then covered with celo-

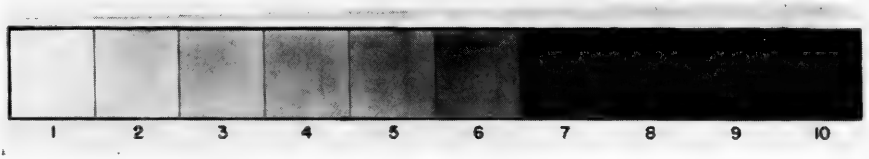

Fig. 1

phane so as to prevent the traceolene from becoming soiled, thus giving a false reading on the meter.

In taking a reading of the densest film, Figure 2A, we found that the meter reading was 3.2. It was then necessary to build up the rest of the films in this series so as to hold back sufficient light in order that a reading of 3.2 is obtained on each film. The series of radiographs were placed in an illuminating box and the variable wedge was inserted between the radiographic mount and the illuminating box. The meter was then placed directly over the individual radiograph and the variable wedge was moved a step at a time from one thickness to ten thicknesses until a 3.2 reading was obtained. A notation was made as to the number of thicknesses of traceolene which were necessary in order to have the same amount of transmitted light pass through that particular radiograph, as was transmitted through the densest film in the entire series. In this manner, it is possible to determine the number of thicknesses of traceolene which will be required to balance each film in a set of sixteen films. A number of pieces of traceolene were cut 1¼″ x 1¾″. These were placed behind each of the x-ray films to hold back the amount of light and in this manner the entire sixteen films balance. Behind the dental mount is a sheet of ground cellophane, for diffusion purposes, held in place by wire staples. These staples are loosened and the small pieces of traceolene are placed between the intra-oral film and the ground cellophane. The wire staples were then tightened so as to hold the dodging material in place. Later

Fig. 2

on, the dodging material can be removed and used again for making other copies.

Considerable time and patience will be required to work out this dodging set-up, but when comparing A with B in Figure 2, the results warrant the effort. For the satisfaction of the reader, the following table will give the number of thicknesses of traceolene that were required to balance the series in Figure 2.

No. of Film	*Thicknesses*	*No. of Film*	*Thicknesses*
1	4	9	2
2	8	10	1
3	8	11	4
4	5	12	5
5	3	13	4
6	4	14	3
7	7	15	0
8	8	16	0

After the intra-oral films have been balanced for copying, they are placed in an x-ray illuminator, and the extraneous light around the periphery of the copy carefully masked out. This is important for it aids in producing a better intermediate film. Focus the camera for the size of the copy desired. We have found that f.22 is the best stop as the numerical aperature of the lens which we use has its greatest resolving power at f.22. One thing that will make a considerable difference is the factor of lens flare. A curve obtained by photographing a step tablet with an untreated lens is quite different from one obtained with a treated lens. The untreated lens produces a curve with a long, flat toe and practically no shoulder. By no shoulder we mean that above a certain density the shoulder just flattens out. With the treated lens, on the other hand, the curve more closely approximates the curves which result when we use a film that has an extremely long scale, which is most desirous for copying any x-ray film. Therefore, in order to get the most out of the film used in making the intermediate negative from the standpoint of exposure scale, a treated lens should be used, or tones in the light areas and also the dark areas are apt to be lost. At the present time the difficulty is that there are few coated lenses obtainable because of the war. Perhaps a rough curve will explain the difference in lens flare in treated and untreated lenses, figure 3. Both curves are from the same type of film developed to the

same gamma. The straight line portion of the curve, for the treated lens shows a higher gradient, which makes it appear as though the negative had been developed to a higher gamma. The films we have

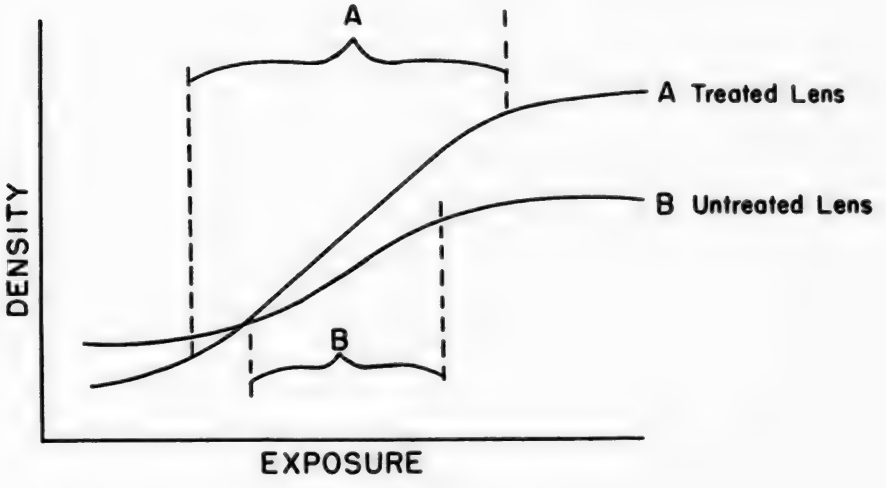

Figure 3

found best for the making of intermediate negatives are Eastman Tri-X, Ortho X and Ss Ortho. We develop this in x-ray developer for fifteen minutes at 65 degrees F. It may be noticed that the intermediate negative lacks contrast but good detail. This lack of contrast can be circumvented by using a lantern slide or paper which is of sufficient contrast to supply the desired results.

CONCLUSION: This method of dodging is practical and the end results are worthwhile. No retouching of the x-ray films is necessary. Chemically reducing of each x-ray film is not necessary and no detail is altered or destroyed on the original film. The materials necessary are: a light box to illuminate the x-ray series; a light meter for reading densities; a variable wedge made of traceolene to determine the thickness in order to balance the series of films, and any type of camera to record the intermediate.

BOOK REVIEWS

THE AMERICAN ANNUAL OF PHOTOGRAPHY—1943—Vol. 57. Edited by Frank R. Fraprie, F.R.P.S., and Franklin I. Jordan, F.R.P.S. Published by the American Photographic Publishing Company of Boston, Mass. 240 pages, 76 plates, 7x9½. Price: $1.50—paper; $2.25—cloth.

The usual standards of excellence are offered in the 1943 edition of the American Annual of Photography. Among the nineteen well illustrated articles in the list of contents, there is one—"Efficient Light Sources in Photomicrography" by D. H. Hamby, that should be of special interest to our B.P.A. members. It is an inclusive, scientific, up-to-the-minute presentation. Henry B. Kane has some really new nature pictures to illustrate his interesting "Nature in Sequence." The Salon Section, mostly of American origin, necessarily due to wartime restrictions, contains many pictures well chosen for diversity of subject matter and artistry. The print criticisms, in a separate department, along with the technical data, are of great interest to any photographic worker wishing to know how and why. The editors are to be commended for a good project, well done, in spite of the publishing handicaps in a world at war. —Ray Miess.

NATURAL HISTORY WITH A CAMERA, by L. W. Brownell, Nature Editor of American Photography, Boston, Mass., American Photographic Publishing Company, 292 pages, 6x9¼, 116 illustrations, cloth bound, $3.75.

This is truly a book that will be thoroughly enjoyed by all lovers of nature and wild life, and will be of definite assistance to the nature photographer. It contains an excellent chapter on equipment, which deals with many interesting details on the habits of wild life, where and when to find the material, how to surmount difficulties in photographing wild things, type of camera, and processing of films and prints. The book then takes up nature studies, beginning with the month of March when Mother Earth awakes, and then progresses month by month, showing the progressing of growth, bloom, and fruit, ending the dissertation with February, the last month of winter. The illustrations are of varied subjects, and represent a fine selection of the usual excellent photographs shown in Mr. Brownell's column. This book should be a valuable addition to any library.

THE YEAR'S PHOTOGRAPHY, 1942-1943. Published by the Royal Photographic Society, London. 51 pages, 51 plates. Price: 3 shillings and six pence. 7 x 9½.

The British photographic workers are apparently progressing at normal speed in spite of the hardships and restrictions they have had to endure. The Year's Photography shows examples of the usual high quality work, notable because pictures reflecting the war are almost entirely absent. There is an interesting comment on the pictures reproduced by I. J. Mortimer, C.B.E., F.R.S.A., Hon. F.R.P.S.; on Lantern Slides by R. H. Lawton, Hon. F.R.P.S., and on Nature and the Camera by Oliver G. Pike, F.Z.S., F.R.P.S., F.I.B.P.

Camera Equipment For the Medical Photographer

by C. H. Richards*

THE first biological picture was made in 1837 — 105 years ago — by J. R. Reade. It was a photograph of a fly made through a microscope with the crude equipment in use at that time. In the early stages of medical photography the equipment was cumbersome and through the years there has been definite progress made in the equipment offered to the medical photographer. We have seen the progress in equipment through the various stages, with the primary change being in the picture size used. In the early stages the 11 x 14 size was used and as photography progressed through the years it brought to the medical photographer sensitized products which permitted the use of smaller sized cameras without loss of detail in the final result, thereby providing compact, portable and more versatile equipment.

As time passed on, equipment was improved upon and designed to do certain work which brought about the use of various sizes and makes of cameras in the medical field. They ranged in size from 8 x 10 and 5 x 7 down to the 35 mm. size. Every photographer has his own individual problems and preferences in equipment. Some will prefer to use the view type camera for their work, requiring the setting up of tripods and lights while others will lean toward the faster films in the smaller size cameras which can be fitted with the speed lenses we are all familiar with today.

Today we are at war where medical photography is playing an important part. This subject has been fully covered by a previous speaker. Photography is the means by which valuable information obtained in any part of the world can be made available to the medical field for reference and further study in order that everyone may gain from actual experiences encountered by others. The units set up under the direction of Lieut. R. P. Creer of the U. S. Army Medical

* From the Folmer Graflex Corporation, Rochester, New York.
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Museum in Washington have selected for their use equipment with which many of us here are very familiar and which has been found to be most versatile in our institutions and hospitals in the United States. I have had the pleasure of working with Lieut. Creer in outfitting the units which will be sent into the field to record on film the story of how medical photography is doing its part in the war. These films will be invaluable in the study of medicine and the men are equipped with the tools to permit them to do the job well.

The 4 x 5 Speed Graphic camera was selected for all the still photography to be done in the hospitals as well as in the field. The only alteration from the basic design of the camera was a special Vernier type focusing scale with calibrations to four feet for close-up shots, and a change in the tubular view finder in order to correct for parallax down to four feet.

In outfitting these units with satisfactory equipment it required a sturdily constructed, precision camera that must be portable and have a bellows draw to permit one-to-one copying. It also must have slow shutter speeds with a between the lens shutter, interchangeable lens equipment, photoflash synchronization, range finder, ground glass focusing, positive track lock for use when the camera is used in a vertical position, and the acceptance of film pack or sheet film. The Graphic camera answered these "musts" and above all provided a unit that has been adopted as standard equipment by the U. S. Army Air Force, Signal Corps, the U. S. Navy, the Coast Guard and many other branches of the Armed Forces and government services.

The cameras were equipped with the Graflex Flash Synchronizer, another unit on which the Armed Forces have standardized. It was felt necessary that a synchronizer with the solenoid release permanently fitted to the lensboard of the camera be supplied. The equipment will be used under varying climatic conditions, thus requiring a synchronizer that will not be seriously affected by changes in temperatures. In conjunction with balanced electrical and mechanical systems the Graflex Synchronizer employs in the inertia-type release, a high-resistance solenoid which consumes a very small amount of current (approximately .75 amps at 4.5.v.) and therefore leaves a great reserve amperage, or factor-of-safety, for ignition of the lamp and to allow wide fluctuations in battery strength. The result is that, once the synchronizer has been adjusted, it will not require readjustment as the battery output is reduced by low temperatures, momentary exhaustion, or age. An added

advantage is that it is not necessary to use a few types of dry cells having special characteristics and which might not be at hand in an emergency; hence any standard cell of appropriate size can be used.

In equipping the medical unit cameras they were furnished with both film pack adapters and Graphic type film holders. Since film in packs is numbered, this did not present a serious problem in keeping records of pictures made. However on sheet film it was felt a means of identification must be fitted into the film holders. This was answered by providing the Graflex Negative Identifier. This identifier consists of a strip of transparent cellulose acetate, 5/16ths of an inch wide, which is notched at each end to permit easy insertion in the holder. Actually only 3/16ths of an inch of the identifier shows on the negative which permits the writing of data or numbers on the identifier so that information is recorded on the negative when exposed. The identifier does not interfere with the loading or use of the holder and is such that it becomes a permanent part of the holder if the photographer so desires. Graflex Acetate Ink is available for permanently marking the identifier and has as its base a fluid which acts as a solvent for cellulose acetate. The identifier can be lettered through the use of any Spencerian pen, using acetate ink when the information on the identifier is to be of a permanent nature. If special identification is desired, applying only to the set of negatives being made, it is possible to use India ink or ordinary writing fluid which can be easily removed from the identifier after the particular negatives have been developed. The information which is placed on the identifier through the use of acetate ink can be removed only if the surface of the identifier, itself, is removed. This means of identifying negatives provides a most positive, permanent record on the film, itself.

As these cameras will be called upon to make pictures through microscopes, adapters were furnished for photomicrography with the Speed Graphic cameras.

The equipment for the Medical Units consists of camera, range finder, synchronizer, sheet film holders with identifiers, film pack adapter, tripod, tilting tripod top, focusing cloth, microscope adapter, four filters and lens hood — all compactly fitted into one carrying case.

While dealing with versatile equipment in the 4 x 5 size we cannot pass up the mentioning of the 4 x 5 Graphic View camera. This camera embodies all of the swings, adjustments and tilts built into the larger picture size cameras of the view type. Too, with the improved sensitized materials, many have adapted this camera for work which

heretofore has been done with the larger cameras without loss of quality in the finished work. This camera offers a unique combination of versatility, rigidity, lightness and simplicity. The camera is designed to accept the same lenses and film accessories as used on the 4 x 5 Speed Graphic camera. The thirteen inch bellows draw of the Graphic View camera offers one-to-one copying with lenses of a focal length up to 6½" which size is recommended as covering 4 x 5 area. If larger images are desired on the film it is possible to use auxiliary slip-on attachments with the lens, or there is available a reducing back to permit the use of the smaller 3¼ x 4¼size film. For the medical photographer who requires a view camera with longer bellows draw there is available the Crown View camera with a bellows draw of nineteen inches. This camera also accepts interchangeably the lens and film attachments of the 4 x 5 Speed Graphic camera.

Taking the next step down to the 3¼ x 4¼ picture size the latest development for the medical photographer is the Super D Graflex camera which is offered with automatic diaphragm control and built-in "open flash" synchronization in addition to the regular recognized features of the Graflex camera. The automatic diaphragm control, available only on the 3¼ x 4¼ Super D Graflex camera, provides for pre-setting the diaphragm before focusing the camera. The camera is focused with the lens wide open, affording a brilliant image on the ground glass that shows every detail of the subject and exact location of the plane of sharpest focus. When the mirror release lever is pressed to make the exposure, the automatic diaphragming mechanism is actuated, automatically stopping the lens down to the pre-selected aperture opening. For example, suppose the picture is to be made at a diaphragm setting of f/16. The stop pin is set so that its pointer is at the f/16 on the aperture scale and the diaphragm lever is then cocked to the full aperture opening, which is f/4.5. The diaphragm control is connected internally with the release lever on the side of the camera and the moment that the release lever is pressed the automatic diaphragm control is released and stops the lens down to the desired opening, which is in this case f/16. Whether the lens is fitted in automatic diaphragm mount or regular barrel mount, it is easily removable from the camera so that other focal length lenses for special purposes can be used.

The "open flash" synchronization built into this camera makes it a natural for medical photography since it permits the use of the SM flash bulb. A previous speaker has discussed the use of the SM flash bulb and the advantages of it in the medical field. With the added

advantage of the automatic diaphragm control, the use of SM flash bulbs with the Super D Graflex camera provides the answer for equipment in the medical field for photography at close range with short duration flash bulbs. Here is how easily it works: the curtain is set at "O", the tension number at "1" and the mirror is set to focusing position. When the mirror release is depressed to take the picture, the mirror rises and ignites the flash bulb just before the curtain begins to close, giving an exposure determined by the duration of the flash bulb used. This is effectively 1/200th of a second with current GE SM flash bulbs. In addition to the SM flash bulb, the regular medium base short duration flash bulbs as well as the No. 5 midget bulb can be used with the Super D Graflex — the exposure being determined by the flash duration of the bulb used.

The 3¼ x 4¼ Super D Graflex camera fitted with 6⅜" lens in automatic diaphragm has a closest working distance of eighteen inches from the subject. For those who may require a camera for work at even closer distances, and equipped with a rising front, there is available the 3¼ x 4¼ Auto Graflex camera accepting lenses up to 7½" focal length, thus providing a larger image on the negative. This camera is not equipped with the automatic diaphragm control or built-in "open flash" synchronization, but through the use of an external switch actuated by the mirror set lever the same type of flash synchronization can be employed.

Taking the next step to the 2¼ x 3¼ picture size there are available both the Speed Graphic and Graflex cameras in this size. A camera in this picture group that has been manufactured for many years is the Graflex Fingerprint camera. It is used by the Department of Justice, police departments and sheriffs' offices for recording fingerprints, signatures and small flat specimens not larger than 2⅛" x 3⅛" in size. This camera has found a number of uses in photography other than the purpose for which it was originally developed. This camera is well suited for photographing small objects or areas on a flat surface. In this class would be small skin lesions and like objects, limited to the 2⅛" x 3⅛" size. The equipment lends itself readily for use in making a series of follow-up pictures of small objects which it is desired to keep under more or less constant observation. The flat type of lighting provided with the Fingerprint camera is particularly suitable for the use of Kodachrome. The camera accepts either film pack or sheet film in any of the regular 2¼ x 3¼ Graflex film accessories. It is a completely self-contained unit, equipped with four miniature lamps

operated by batteries housed in the camera box. These lamps are located inside the camera, back of the front aperture, easily accessible for removal and are automatically controlled, properly illuminating the subject as the exposure is made. By slightly depressing the shutter lever the lights are turned on to facilitate properly placing the camera over the subject. The lens is an f/6.3 Kodak Anastigmat which is mounted in the camera so that it renders a full size image of the subject with excellent definition.

With the lighting built-in and no focusing required for each picture, it means that all negatives in a series of follow-up pictures will be alike — an important requirement when observation and information are to be obtained from these photographs. The unit weighs only six pounds, is readily portable and requires no focusing or the setting up of lights and tripods before each exposure, thus cutting down the time required for the making of the picture as well as the inconvenience to the patient being photographed. This camera with its multiple uses makes it a unit for every photographic laboratory. In the confined quarters of a doctor's office the Fingerprint camera would provide a compact unit for quickly recording facts for observation or further study. Its simplified operation requires no photographic skill on the part of the user, assuring him of satisfactory results without the necessity of setting up bulky equipment and special lighting methods.

In the 35 mm. size equipment there has been developed and marketed the Graflex Photorecord equipment which is used in the medical field for the recording of case histories and X-rays on 35 mm. films. The Graflex Photorecord was developed as a portable unit accepting 100 feet of film that could be set up where electric current is available. The Photorecord equipment permits the making of 1600 single frame, or 800 double frame, pictures on the 100 foot roll. It is not necessary to take the entire 100 feet of film before removing it from the magazine since the magazine is protected by a slide so that it can be readily removed from the camera unit without disturbing the setup of the machine. The magazine, when removed from the camera, can be taken into the darkroom and the used portion of the film removed, leaving the unused portion in the magazine for future use. Many times the occasion will arise when it is necessary that valuable case records be made available to others at distant points. If the importance of the case is such that the material should not be removed from the files, it is possible to provide this information through the use of microfilming. The Graflex Photorecord permits the recording on 35

mm. film of material from file card size up to 18" x 22" under the normal setup and if larger copies are desired the unit is adaptable for taking care of this need. It is possible through this method to save up to 95% of the storage space of records and in addition have available a ready means for referring to this material. If duplicates are desired from the original negatives this can be handled inexpensively, thereby making the material universally available to the medical field.

A problem that confronts many institutions is that of handling radiograph films. Much of this early film has a nitrate base which makes it very dangerous to store and handle. Also the large size of the films makes it necessary to have special filing systems all of which take up considerable space. The Photorecord equipment is a means by which X-rays can be reduced to 35 mm. size. In order to preserve proper tonal relationships which are so important in the reading of X-rays, it is necessary to be sure that when copying X-rays the entire film shall be evenly illuminated. It is also advisable to keep a very careful control over the exposure and development so that the density of a film copied one day will be exactly the same as that copied a week hence. This is especially important when comparative cases are being studied. The Photorecord is set up so that the camera is centered over the illuminated area and the exposure is made through the use of a foot treadle, leaving the operator's hands free. By reducing X-ray films to 35 mm. size it provides a more convenient method of storage for this invaluable material. Since ground glass focusing is provided for, it makes it adaptable for photomicrography either with the 35 mm. magazine or with the 2¼ x 3¼ Graflex film and plate attachments.

Colored film is of primary importance in the medical field. We have received requests from owners of Speed Graphic cameras for a special adapter to permit the use of the 35 mm. and Bantam size color films in their cameras. Although at the present time the Folmer Graflex Corporation is not in a position to supply a unit of this type, the Bantam Kodachrome Adapter made by the Eastman Kodak Company can be adapted for use with these cameras.

Cameras having a Graflex back can be adapted for use by cutting one piece of plywood or tempered pressed wood just large enough to fit in the recess of the camera back. A second piece of thinner plywood is fastened over this to raise the Miniature Kodachrome Adapter clear from the protuberance of the locking bar. The adapter is then fastened to this assembly over a hole of suitable size.

Cameras having a Graphic back can be adapted by removing the focusing panel and the springs — done by taking out the two screws holding the springs to the camera back. You can then construct your special adapter frame in such a way that it would be held to the camera back by means of clips held in place by the two screws threaded back into their respective openings.

We have discussed camera equipment for the medical photographer. The success of any equipment depends upon the man back of the camera. Photographers, amateur and professional alike, have found "Graphic-Graflex Photography", published by Morgan & Lester, to be a valuable asset not only in getting acquainted with their equipment but as a ready reference book on photography. Of special interest to the group here are chapters written by Hansel Meith on "Science Pictures for Publication" and by Julius Weber on "Photomicrography with a Graflex."

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"HEALTH FILMS"

For the first time since 1924 the health film resources of the United States have been comprehensively surveyed, and the results have just been published in a pamphlet entitled "Health Films". It contains a descriptive list of 219 selected motion pictures, arranged under 38 subject classifications. Publisher is the American Film Center, a non-profit educational organization, supported by a grant of the Rockefeller Foundation.

This list is intended to help health educators, teachers and others to find the films they need, and is of special interest at the present time when the teaching of health has become more than ever an important national concern.

"Health Films" is available at 25 cents a copy (lower rates for larger quantities) from Section on Health and Medical Films, American Film Center, 45 Rockefeller Plaza, New York.

Filming Vi Agglutination and Some Remarks on Microcinematography

Andrianus Pijper*

Purpose of Paper

TYPHOID bacilli can be agglutinated by serum in three ways, H, O, and Vi agglutination. The mechanism of H and O agglutination has been studied by means of sunlight darkground microscopy (1), and illustrated by a 16 mm. film (2). It was shown that H aggultinins cover the motile organs of typhoid bacilli with a sheath, and that these thickened and stiffened organs subsequently become mechanically entangled. In O aggultination the normal mutual repulsion of the bacilli is seen to change into mutual attraction, and the bacilli move toward one another head first. This results in a definite and regular pattern of the resulting clumps, all attachments being either end-to-side, or end-to-end, and the final clumps resemble crystals.

Sunlight is essential for this work as it is the only light that is strong enough to make visible, and permit photographing the organs of locomotion of typhoid bacilli as shown previously (3, 4, 5).

By the same method the mechanism of Vi agglutination has been studied. Its features were found to be quite different from those of H and O agglutination (6). A 16 mm. film of the Vi agglutination process was filmed, which is herein described with a few remarks on the making of such films.

Technic

For a detailed description of the technic a previous paper must be consulted (5). The main points are as follows: A Zeiss heliostat with a mirror of 18 cm. throws a beam of sunlight through a small sliding door into the laboratory. The beam is focussed by a 2 metre

* Received for publication October 31, 1942, from the author's private laboratory, Pretoria, South Africa.

focus collector lens into a Siedentopf cardioid dark ground condenser, which is attached to a nearly horizontal microscope stand. A drop of a fresh broth culture of typhoid bacilli, preferably Felix's strain Ty2, is placed on the special mica-glass slide described previously (5, 6), and covered with a coverslip which is sealed with vaseline except for one corner which remains open. If the preparation, viewed by dark-ground method, appears suitable, a drop of Vi agglutinating serum is placed at the free corner of the coverslip, and allowed to diffuse into the preparation.

In the making of this film several magnifications are used, as occasion demands. They vary from 50 x to 200 x. The Zeiss oil immersion 60 x with iris is generally used because of its adjustable aperture. It is regrettable that there are not more high power oil immersions provided with an adjustable iris (the funnel that some firms provide is at best a make-shift), however microscope makers to my knowledge are not in the habit of consulting their customers.

In addition to using different magnifications, it becomes necessary to use lightfilters occasionally. The Vi agglutination process consists of various phases. In the beginning the motile organs are chiefly concerned. These can only be brought out by using the maximum amount of light available. This leads to overexposure and blurring of the outlines of the bacilli which are so much brighter than the motile organs. In the later phases however the walls of the cells play the more important part. The light must then be reduced to obtain crisp outlines. This is accomplished by using various dilutions of Zettnow's filter, the strength being adjusted to the magnification used.

As photographic material, Kodak Super XX film is used throughout.

The Vi serum is made from rabbits by injection of formalised Ty 2 cultures. The H and O agglutinins are absorbed out. This leads to the formation of giant conglomerations of motile organs, caused by H agglutinins. These are hard to get rid of, short of filtration, which adversely affects the potency of the serum in Vi agglutinins. Centrifuging removes most of them, but they appear here and there in the film, and of course have nothing to do with the Vi agglutination process.

Difficulties to be Met

It must be remembered that films of this kind cannot be made in a few sittings. As a matter of fact this film took years to complete. This is partly due to the fact that sunlight is not available every day.

The chief factor causing delay is the tediousness of all agglutination processes and Vi agglutination is easily the most tedious one. A motile strain of bacilli is used in order to bring out essential features of the process, which concern the motile organs. The motility, which persists after agglutination clumps have already been formed, makes it difficult to follow the fate of any given bacillus or clump. Moreover, sunlight is available at its best for a few hours only during any working day. For the study of more advanced stages in the agglutination process, microscopic preparations are prepared the night before. Thus the film consists of a large number of separate pieces, made on different dates, which might be months or even years apart.

Editing becomes a very involved process, as is usual in such work. Suitable scenes are cut out of the usual 100 feet lengths of film as they come back from processing. These are put away in envelopes, on which an accurate description of the contents is typed.

After many months several hundred of such envelopes had accumulated. The usual thing then is to begin piecing the film together on paper. This is done by putting the envelopes in some sort of orderly sequence, guidance being given by their typed contents. Of course it is important, from the very beginning, to have a clear conception of what is to be presented. This can only be achieved by studying the process to be filmed under the microscope for a long time, without any filming.

In the first effort of producing a connected whole, by arranging the envelopes it was soon discovered, as is usually the case, that the film was by no means ready to be spliced together. Some essential points were missing, or poorly represented. This necessitated the exposure of more film in order to fill in the gaps.

This is again one of the most difficult parts of the undertaking. It stands to reason that the missing parts and the parts that were not well done usually concern the happenings that are rare or difficult to photograph. It always takes a considerable amount of film and time to get just these scenes that are essential for continuity and clarity. Eventually, however, the defects can be overcome, and the film regarded as complete.

Titles are prepared in the meantime. The problem now is to splice all the available pieces together, guided by the wording on the envelopes.

In the case of the Vi agglutination film under discussion, more than 5,000 feet of film had been exposed. The preliminary sorting

out resulted in about 200 pieces that were regarded as suitable for a place in the film. On splicing these together it was found that they constituted a total length of 1800 feet. The preliminary waste of film therefore amounted to about two thirds of the film used. This is not unusual in films of this kind. Bacteria cannot be stage-managed; the stage is very small, and the actors somewhat wayward. Exact focussing in more than one level is not possible. As everybody knows, a photographic picture is never better than expected, but always worse. What the eye sees so very clearly does not always appear on the film. The best scenes are easily spoiled by the sudden appearance of a stray bacillus. A small airbubble, suddenly expanding at a distant spot, may throw everything out of gear. A tiny passing cloud may play havoc with the light. And finally there are the interruptions caused by the routine work of the laboratory.

It is therefore no wonder that of every 100 feet exposed only about one third did pass muster at the first inspection, and that of the total 5,000 feet a provisional film of only 1800 feet could be put together.

It might be suggested that greater economy could be accomplished by exposing less film in the first instance. There is something to be said for this view. But as the conduct of bacteria under a microscope is quite unpredictable, a number of successful shots would be missed if the risk of a large number of failures were not taken.

The 1800 feet which are left of the original 5,000 feet are spliced together as a provisional continuous film. This is then put through the projector several times and studied in detail. A running comment on the whole film is carefully recorded scene by scene.

With the aid of these notes further cutting out is undertaken. For this operation a film viewer is a very useful adjunct. The first parts to be taken out are unnecessary duplications and redundant scenes. But there is a good deal more to it. Viewing 1800 feet of film of somewhat irregular quality automatically raises the standard as to what is acceptable. Minor defects, at first overlooked, such as glaring particles in the field, become really objectionable. An occasional greyish background or scratches, which seemed passable at first, become obnoxious when following a technically more successful section. Sometimes a particular scene has to be kept because it seems hardly likely that it would ever present itself again for filming, although its technic is not above criticism. Thus by constant elimination and selection, the provisional film of 1800 feet is gradually reduced to its final length

of about 900 feet. The total wastage therefore in making this film amounts to more than 80%. It is obvious that in making films of this kind this apparent waste of film cannot be eliminated.

In editing films of this kind there is a special difficulty as to how much should come out. Repetition and tediousness must, of course, be avoided. The film is supposed to show something no one has seen before. It is a document and should be treated with circumspection. Naturally, in the course of the observations, a definite conception of the process has been formulated. However, these conceptions should not be too rigidly adhered to. An author is entitled to present that which conforms to his theory, yet it is also important to retain that which might be capable of a different explanation. The phenomena should not be forced into a rigid preconceived pattern. A balance should be fairly established between that which is deemed to be essential and should be emphasized, and that which perhaps does not appear to be quite relevant but does happen. In an impartially made film of this kind even the actual maker should at a later date be able to discover new features.

Contents of Film

The film is rather long because Vi agglutination is a complicated and slow process. The purpose of this presentation is to show that in Vi agglutination there is no definite force that brings the bacteria together. The growth of clumps is haphazard. Clumps may break up again. What holds clumps together is referred to as "stickiness", a term which seems to describe the process.

The film is best described, and the process of Vi agglutination best understood, by enumerating the subtitles in their order, and indicating briefly what each section contains.

Sub-Titles and Contents of Film

(1) Young typhoid bacilli with long spiral tails do not collide.
Short section showing normal bacilli speeding along with long tails, and never colliding.

(2) Older bacilli occasionally show "fatigue" or paresis of tails. In old broth cultures an occasional bacillus becomes slow and the long drawn-out tail has become a broad spiral, figure 1, revolving slowly.

(3) Addition of Vi serum to young bacilli.
A drop of serum is seen to be added to a corner of the coverslip of the preparation on the stage of the microscope.

(4) The Vi serum diffuses.
The bacilli are swept along by fast currents, but they do not collide.

(5) The Vi serum causes acute and general "fatigue".
Long section, showing how at first an occasional bacillus shows "fatigue" and gradually the effect spreads to more and more bacilli, figure 2, at an ever increasing rate. One bacillus is seen to untwist his tail, twist it together again, and then finally untwist it in complete "fatigue".

(6) The "fatigue" or "paresis" causes erratic movements.
The many affected bacilli no longer swim straight, but meander. Some make sudden stops, and then go on again. Others move sideways, or even backwards, with the tail in front.

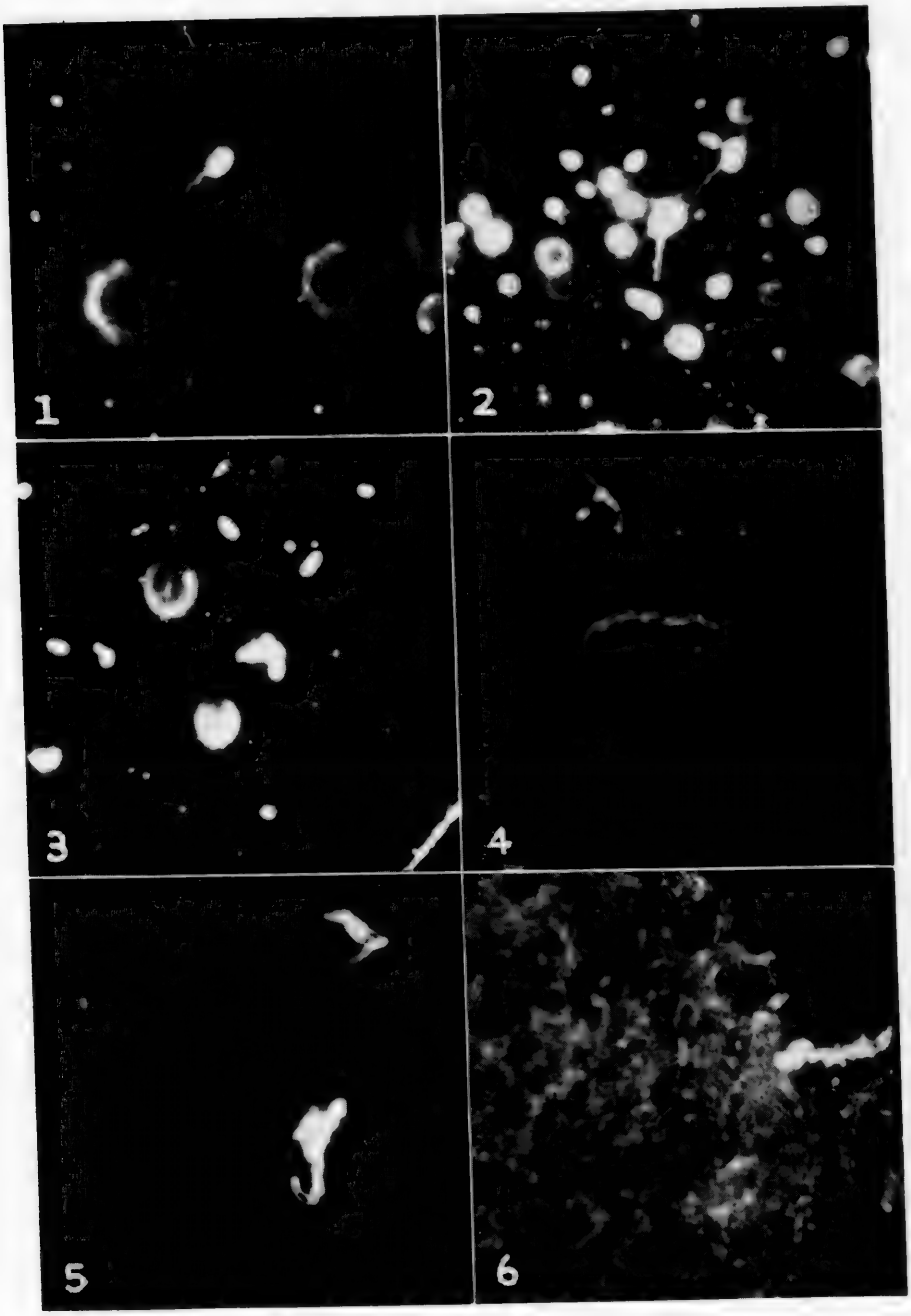
(7) Erratic movements lead to collisions.
The erratic movements of the previous section lead to bacilli bumping into one another. They obviously can no longer govern their movements, and their natural mutual repulsion is sometimes overcome.

(8) There is no mutual attraction.
Short section showing how meandering bacilli can dance round one another in close proximity without ever touching.

(9) Some bacilli remain stuck and start clumps.
Bacilli, thrown together by their erratic movements, sometimes remain stuck. Others join the group in the same haphazard way. In figure 3 a third bacillus is just becoming attached to two others.

(10) What is the cohesive force? Stickiness?
Small groups are shown from which a single bacillus tries to twist itself loose. The impression given is that they hang together merely by stickiness.

(11) Note parallel structure of clumps. Stickiness?
Some very clear small groups are shown where the bacilli are attached to one another lengthwise. Such groups appear rather stable, and the impression is that the larger the area over which the bacilli touch, the more stable is the attachment, figure 4.


1
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(12) Bacilli are not attracted by clumps.
Small clumps are shown with single bacilli dancing around, but there is no tendency to become attached.

(13) They often just steer clear of them or are repelled.
In continuation of the previous section it is shown that a bacillus can wander about a long time, approach small groups, and escape entanglement every time. It may steer its way rather helplessly and yet steer clear of groups.

(14) Small clumps can swim, but erratically. Note parallel pattern.
Shows that small clumps keep on moving in the same way as single bacilli. The lengthwise attachment, producing parallel structure, is becoming manifest.

(15) Tails or flagella still there.
By overexposure of the bodies of the bacilli, waving motile organs become visible at the periphery of small clumps. They are of the broad spiral shape.

(16) Tedious growth of small clumps. Note parallel adhesion.
Long section meant to illustrate how long it takes for small clumps to become bigger. Single bacilli join, but the process is very slow. In figure 5 a double bacillus has just joined and is slowly swinging round to become attached lengthwise to the clump.

(17) Clumps do not attract one another.
Erratic movement of small clumps brings them into close proximity but there is no tendency to combine.

(18) Clumps may break up again.
The old erratic motility is seen to get the better of the stickiness and some clumps fall to pieces.

(19) Clumps finally grow and join through erratic movement and stickiness.
A number of smaller clumps are seen to come together accidentally and form larger clumps, again suggesting that what holds them together is stickiness. Further additions to the clumps are made by isolated bacilli in haphazard fashion.

(20) Clumps folding up through stickiness.
Elongated clumps perform somewhat acrobatic movements, and when the ends come into contact they stick and the clump rounds itself off.

(21) Final stage: large clumps, note parallel pattern.
As, during their formation, clumps cannot always be kept focussed, this section shows ready-made clumps of varying sizes. They specifically illustrate the typical pattern of Vi agglutination clumps, parallel adhesion of the bacilli (figure 6). Attention is then drawn again to this characteristic feature in the final title which reads: Vi agglutination is: impeded motility, erratic movements, collisions, stickiness, leading to parallel pattern.

SUMMARY

The technic of making a microcinematographic film of Vi agglutination by means of sunlight darkground microscopy is described.

Special reference is made to the difficulties arising through filming processes that extend over many hours whilst the essential source of light, the sun, is only available for a few hours per day.

The editing of this kind of film, which is supposed to show phenomena new to science, is discussed, and reasons given why particular discretion should be exercised.

The film, as indicated by the sub-titles above, illustrates that Vi agglutination is mechanically quite different from both H and O agglutination. In Vi agglutination there is no particular force that brings bacteria together. The first effect of Vi serum is on the motile organs. The resulting paresis causes accidental collisions, which may or may not result in permanent adhesions. The bacteria are seen to become eventually very closely bound together through a curious stickiness of their walls, and this produces a definite and characteristic pattern in the structure of the clumps.

NOTE: Owing to wartime conditions requests for duplicates of this film (about 900 feet) cannot be entertained at the moment, but they will be filed and fulfilled as soon as circumstances permit.

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President's Address

Leonard A. Julin*

FOR the enlightenment of our new members it seems fitting that this introduction to the twelfth annual convention of the Biological Photographic Association should review some of our achievements and consider some of our future activities.

Prior to the formation of this organization there were a number of us engaged in photographic duties in the biologic sciences. In this field we encountered many photographic problems and in solving them we derived a measure of personal satisfaction. But it also caused us to wonder if other photographers had found simpler or better solutions to similar problems. Such disquieting thoughts might have induced us to reconsider our solution to some problem and led to improved results. But before this could be done we received another rush job involving a new photographic problem, the solution of which again produced a sense of satisfaction mingled with doubt. To this was added frustration when our next problem completely baffled us. At such times we longed for a chance to visit fellow photographers to learn how they were solving similar problems and to see what equipment they were using. Few of us found opportunity to travel so we plodded along working and wondering how our results compared with those of the next fellow. Because we saw photographs published in scientific journals and because we saw lantern slides and motion pictures used at meetings we knew that a considerable number of persons were engaged in our branch of photography. Who they were or how they carried on their work we did not know. Such was the situation when, in 1931, one of us decided to do something about it. That one was Mr. Ralph P. Creer who was doing clinical photography at Yale University. As a result of his efforts, a meeting was arranged. This was attended by twenty-eight persons who enthusiastically co-operated in forming the Biological Photographic Association. They chose Mr. Creer to be president and he voiced their opinions when he stated, "This association must remain unselfish in its aims. It must not be used for purely self-protective purposes; it is not a trade union. Its purpose

* Section on Photography, Mayo Clinic, Rochester, Minnesota.
Read before the twelfth annual meeting of the Biological Photographic Association, New York City, Sept. 10 to 12, 1942.

must be to help and stimulate its members so that biological photography may be employed ever more efficiently in its primary purpose, namely to further the study of photography in relation to the biological sciences and to improve its technic." The following year he again announced the purpose of the new organization when he stated, "It is by no means a professional union organized to set price standards, or to dictate in any way to its members. It is truly a scientific society, made up of persons directly engaged in, or interested in this field, endeavoring to establish certain standards of quality, and to elevate those standards to the highest degree." This was to be the guide for our future course of action. How faithfully have we adhered to it and what have we accomplished?

The original plan was to hold an annual meeting for the exchange of ideas but such meetings could be attended by only few of those we hoped to aid. The need for an association journal was evident and within a few months it was decided to start such a publication. After much preliminary work, arrangements were completed for publishing a quarterly journal. For such a young society this was an outstanding achievement, especially when only meager funds were available. The new journal contained fine and valuable articles and it became quickly the pride of our members. Within a few months, however, an economic depression swept the country and the journal seemed doomed to an early death. It was only due to the careful guidance of the board of directors that the journal continued to appear. There followed several years of trying times during which we found it necessary to change publishers more than once. Finally, when certain outstanding financial obligations had been cleared up, the journal became the property of the association. Incorporation procedure was completed and the association now is publisher of its journal, the printing being done by contract. Much credit is due Mr. Louis Schmidt, our second president, for the unlimited time and effort he expended successfully for the association and the journal during those years of trial and tribulation. So necessary were his services that we retained him as president for six years in spite of his desire to retire sooner. When the association assumed the role of publisher it purchased all back numbers from previous publishers. Under the guidance of our editor and his editorial board, the journal has become a valued source of information pertaining to biological photography. But the journal represents only one of our achievements.

An annual meeting has been held each year since that first meeting in 1931. At these meetings we have had the pleasure of becoming

acquainted with many of our fellow workers and valued friendships have resulted. Excellent talks and demonstrations have been provided but even more valuable to many of us have been the things we learned from discussions with the members present. Manufacturers of photographic and optical equipment have sent representatives to our meetings and they have discovered that our problems differ from those of the amateur and the professional photographers in general. As a consequence, they have given us valuable assistance and information which we, as individuals, would not have encountered without our organization. Much of this information is presented informally only at the meetings and is one of the attractions of our meetings.

While we became acquainted with fellow members at the meetings it was soon decided that exhibitions of photographs made by members would form excellent aids in comparing and improving our workmanship. Our first exhibit was held in 1934 at our meeting in New York City. Comparing the photographs in that exhibit with those of our current exhibition confirms the impression that we have successfully adhered to our purpose in improving photography in the biologic sciences. The annual exhibits have formed the basis for our travelling salons which may be borrowed by any of our members. Permanent albums of photographs also have been prepared which contain examples of equipment and technic used by various members. These may be borrowed by any member.

Special committees have been appointed from time to time as the need arose. The Committee on Motion Pictures under the chairmanship of Dr. Oscar W. Richards has functioned for a number of years and has made a survey of biological films suitable for use in teaching. It has published a list of recommendations pertaining to the production of such films.

Several years ago Mr. Creer proposed that we offer the co-operation of our association to the War Department and he served as chairman of the Committee for Co-operation with the Army. Conferences were held with the Surgeon General and questionnaires were sent to our members. The information obtained was given to the War Department and after this country entered the war Mr. Creer became a commissioned officer in charge of medical illustration units at the Army Medical Museum. Several other members have since joined that branch of service.

Membership committees have functioned at various times but there has been some debate about staging intensive membership drives. Some

members were of the opinion that the cost of such campaigns would be greater than our limited funds warranted. Others thought we should not extend our membership beyond the rather small group of full-time photographers who formed most of our early roster. They believed that dividing our activities between the professionals and the nonprofessionals would dissipate our effectiveness. However, it was decided that each member try to obtain a new member and this has resulted in an increase without the expense of an advertising campaign. Each year has found us with a larger membership than we had the preceding year and with this growth has come a change in the composition of our membership. A recent survey shows that most of our new members are nonprofessional photographers and that the professionals now form the minority of our total membership. More than 100 libraries and institutions subscribe to our journal and their copies are read mainly by the amateur photographers. However, the members who are full-time photographers are the ones who take a most active part in the activities of our association. They are the ones who manage our affairs. They contribute most of the photographs to our exhibits and attend our meetings more regularly. As already stated, they were the ones who longed for an organization whereby they could meet their fellow workers and discuss problems they had in common. So when the Biological Photographic Association was formed it naturally catered to their needs. That it has served them well I have no doubt, and many of the benefits have been shared by the amateurs. But as the latter group is now in the majority we may ask if they are not entitled to more special consideration? Remembering the purpose of our organization it is clearly our duty to help all of our members as much as possible. How then are we going to be of most service to the increasing number of new members who have limited photographic training?

It has been suggested that we publish an instruction book for their guidance. The financial hazard involved has been considered too great for us at this time. We have tried to give aid by correspondence when members have written for information and there has been personal consultation in our exhibit booths at medical conventions. But these methods have helped a relatively small group of persons. Many helpful articles appear in our journal but obviously it cannot take the place of a textbook. Pamphlets could be prepared covering various phases of biological photography and they would be available to all members. This seems to be a worth-while project.

During the past year questionnaires have been sent to all members, and from the information obtained we hope to classify the members according to interests and photographic experience. Our secretary has made a study of the many questions asked by members and by visitors at our exhibits. From all these data we should be able to provide more information and instruction for our members according to their needs. We also plan to assign to each branch of biological photography qualified members who can keep us informed about photographic items of interest in their specialties. They also can suggest how we can aid the workers in those fields. This is a project of considerable magnitude but it should prove very beneficial to the association and of great value to new members.

After reviewing the results of Mr. Creer's inspiration and achievement in organizing our association, and Mr. Schmidt's success in overcoming the many discouraging problems that arose during his years in office, I realize how uneventful have been my two years of service as the third president. The expense of changes in publication of our journal and the purchase of back numbers helped drain our treasury until it was in a precarious position two years ago. We realize that this was a temporary condition but our first task was to improve our financial state. Through the efforts of our editor, Mr. Leo C. Massopust, the cost of the journal has decreased. Profit from the sale of back numbers is now demonstrating the wisdom of that investment. A number of economies in association administration were effected and all have aided in bringing our cash balance to its highest point to date. Our membership has continued its steady growth and is larger than heretofore.

One of the time-consuming jobs we have had during the past two years has been the selection of a convention city. Owing to the prevailing unsettled conditions the decision was left in the hands of the board of directors. Last year, after the decision had been made, it was necessary to change our plans so that very little time was given to the program committee. This year a change again was necessary. First it was decided that we should meet in Cincinnati but the war program involved our members in that city so they were unable to handle the local arrangements. The government's plea that travel be curtailed prompted us to meet in New York City since many of our members reside nearby. The convention committee had only a few weeks in which to perform duties usually requiring several months. The fine program which has been arranged is tribute to their industry.

Last year, and again this year, our association had an exhibition booth at the convention of the American Medical Association. The preparation of these exhibits involved much work. While a number of members contributed prints and transparencies, the exhibits were planned and prepared by Miss Anne Shiras and Mr. Albert Levin. These two members travelled to the convention cities and worked long and hard at the booth each day. Through their efforts we obtained a number of new members and a great deal of favorable publicity.

Last year we had an exhibit of prints at the convention of the Photographic Society of America. We also had a booth at the Congress of the American Academy of Ophthalmology and Otolaryngology. These two exhibits were held in Chicago and were handled by our members in that city.

The Pittsburgh chapter has continued its activity in collecting and indexing articles from our journal to be used as a source of information for our members. It was this group, too, which had the first eight volumes of our journal copied on microfilm at no cost to the association.

Obviously we have a number of members who have helped make our association the recognized authority in its field. No one member, however, has worked as hard and enthusiastically as our secretary, Miss Shiras. The duties she voluntarily accepted when the association was small have multiplied as the membership and activities increased until now she has more than she can handle alone. Since we cannot afford the expense of a hired secretarial assistant she has agreed to list some of her duties which can be transferred to other members. Some of you will be asked to assume those duties and from your past co-operation we know you will respond with your whole-hearted support.

Last year the Photographer's Association of America proposed that we hold our conventions in conjunction with their annual meetings. A committee of our members visited their convention and discussed the proposal with their officers. The report which our committee presented to us received much consideration but we have decided to continue meeting independently.

A conference on motion pictures was held in connection with the annual convention of the American Medical Association this year. Our Motion Picture Committee represented our association at the conference and participated in the formation of The American Committee on Biological and Medical Films. The latter group is planning a very extensive program and it is expected that our organization will participate in that project.

It is evident that the Biological Photographic Association is gaining recognition as a respected authority in its field and with this recognition come obligations and responsibilities which we should not ignore.

The early years of our association were a struggle for existence and our efforts were confined to self preservation but we now have reached the state where we can divert some of our energies in other directions. One obligation which is becoming increasingly apparent is that we are expected to co-operate with other organizations when our services appear to be of value. This we should be proud to do. Our main responsibility, however, is to help and stimulate our members according to their needs and as most of our new members are not highly skilled in photography I believe our educational program should be expanded. This would be in accord with the hopes of our founders to improve biological photography and "establish certain standards of quality and to elevate those standards to the highest degree."

News From the Trade

Professional Films, Plates and Papers Available From the Eastman Kodak Company as of November 12, 1942.

Subject to cancellation or change at anytime without notice. For definite information as to speed and contrast write Eastman Kodak Company for booklet, or, call your local demonstrators.

PAPERS

Name	*Grade*	*Contrast*	*Weight*
AD-TYPE	A	0, 1, 2, 3, 4, 5	single
AZO	CF, E, F	0, 1, 2, 3, 4, 5	single
AZO	C (formerly AA)	1, 2	double
AZO	E, F	0, 1, 2, 3, 4, 5	double
AZO	G, P	1, 2, 3, 5	double
AZO	J, X	1, 2	double
AZO	Q	2	double
AZO	Y	1, 2, 3	double
KODABROMIDE	A	1, 2, 3, 4	light
KODABROMIDE	E, F, N	1, 2, 3, 4	single
KODABROMIDE	E, F, G, N, P, S	1, 2, 3, 4	double
KODABROMIDE	W	1, 2, 3	double
KODALURE	G, J, R, S, W	normal	double
NEWS BROMIDE		(normal, medium, contrast, extra contrast)	single

P.M.C. Name changed to Kodak Royal Bromide, see list given as Kodak Royal Bromide.

Name	*Grade*	*Contrast*	*Weight*
VELOX	E, F	2, 3	double
VELOX RAPID	E, F	2	double
VITAVA OPAL	G (formerly T)		medium
VITAVA OPAL	B (formerly A)		single
VITAVA OPAL	B, G, H, L, P, U (formerly W), Z		double
VITAVA PROJECTION	C, U (formerly W), X	0, 1, 2, 3, 4, 5	single
VITAVA PROJECTION	B, G, Y	0, 1, 2, 3, 4, 5	single

KODAK ROYAL BROMIDE				P.M.C.
Grade A	1, 2, 3, 4	light weight	The same surfaces transferred.	not listed
Grade E	1, 2, 3	single weight		No. 2
Grade F	1, 2	single weight		No. 1
Grade M	1	single weight		No. 5
Grade T	1, 3	single weight		No. 3
Grade E	1, 2, 3, 4	double weight		No. 3
Grade F	1, 2, 3, 4	double weight		No. 10
Grade G	1, 2, 3, 4	double weight		No. 11
Grade M	1	double weight		No. 6

FILMS

Eastman Professional Safety Films, now available.

Kodachrome Prof. Film (Daylight Type)
Kodachrome Prof. Film (Type B)

NON-COLOR-SENSITIZED.

Commercial A. H.
Commercial Matte A. H.
Kodak Safety Positive (35mm).
Kodak H. C. Safety Pos. (35mm).

ORTHOCHROMATIC

Ortho X. A.H.
Super Ortho Press, A.H.
Super Ortho Press (*Film-Pak*)
Super Speed Ortho Portrait. A.H.
Contrast Process Ortho. A.H.

PANCHROMATIC TYPE-B.

Super Panchro Press Type B, A.H.
Super XX Pan. A.H.
Portrait Pan. A.H.
Panatomic X. (*Film Pack*).
Kodak Micro-File (35mm).

PANCHROMATIC TYPE-C.

Tri-X Pan. A.H.
Super XX (*Film Pack*).
Kodak Direct Positive Pan. (35mm).

INFRARED SENSITIVE

Infra-Red Sheet Film.

PROFESSIONAL FILMS DISCONTINUED AND SUBSTITUTES

Eastman Par Speed Portrait	Super Speed Ortho Portrait. A.H.
Eastman Commercial.	Eastman Commercial. A.H.
Eastman Commercial Matte.	Eastman Commercial Matte. A.H.
Eastman Process	Eastman Contrast Proc. Ortho. A.H.
Eastman Process Panchromatic.	Eastman Contrast Proc. Pan. A.H.
Eastman Commercial Panchromatic.	Eastman Super Panchro Press Type-B. A.H.
Eastman Super Sen. Panchromatic.	Eastman Tri-Pan. A.H.
Eastman Panchro Press.	Eastman Super Panchro Press Type-B. A.H.
Eastman Commercial Ortho-A.H.	Eastman Super Ortho Press. A.H.
Eastman Panatomic X.	Eastman Super Panchro Press Type-B. A.H.
Eastman Super Pan. Press Type C.	Eastman Super Panchro Press Type-B. A.H.
Kotava Safety Positive.	Paper can be used.
Eastman Auto Pos. Commercial	None (A.H. Antihalation)

PLATES

NON-COLOR-SENSITIZED.

Eastman 40. A.H.
Eastman 33. A.H.
Eastman Process.
Eastman Contrast Process. A.H.
Eastman Lantern Slides. Medium and Contrast. A.H.

ORTHOCHROMATIC

Eastman Super Ortho Press. A.H.
Eastman 50. A.H.
Eastman Polychrome. A.H.
Eastman Commercial. A.H.
Wratten Metallographic. A.H.

PANCHROMATIC TYPE-B.

Eastman Tri-X Panchromatic Type-B. A.H.
Eastman Tri-X Panchromatic Type-B. Matte A.H.
Kodak Panatomic X. A.H.
Wratten Panchromatic. A.H.
Wratten Process Pan. A.H.
Wratten "M". A.H.
Kodagraph C.T.C. Pan. A.H.

PANCHROMATIC TYPE-C.

Eastman Super Panchro Press.

INFRA-RED SENSITIVE.

Eastman Infra-Red Process. A.H.
Eastman Infra-Red Sensitive. A.H.

PROFESSIONAL PLATES DISCONTINUED AND SUBSTITUTES

Eastman Universal.	Eastman 40. A.H.
Eastman 33.	Eastman 33. A.H.
Eastman S.C. Ortho.	Eastman Polychrome. A.H.
Eastman D.C. Ortho.	Eastman Polychrome. A.H.
Eastman Post Card	Eastman Commercial. A.H.
Eastman 33 Gravure. A.H.	Eastman 33. A.H.
Eastman Lantern Slide (Soft).	Eastman Lantern Slide Medium.
Wratten Panchromatic.	Wratten Panchromatic. A.H.
Wratten Tricolor Panchromatic.	Eastman Tri-X Panchromatic Type B. A.H.
Wratten Tricolor Panchromatic (Matte).	Eastman Tri-X Pan Type B. Matte A.H.

News from Agfa Ansco:

AGFA Ansco Trade Journal Becomes the Ansconian. Beginning with the January-February issue, the trade journal published bi-monthly by Agfa Ansco will change its name from *The AGFA Diamond* to *The Ansconian.* Accompanying the new name will be an improved design and layout for both the first and second covers. Unchanged will be the principles established during the Diamond's six year existence of providing photographers all over the country with worthwhile product information and interesting articles on pertinent photographic subjects.

It is interesting to note that the word Ansconian is derived from the first two letters of Anthony, the name of the man who founded the company in 1842, and the first syllable of Scovill, whose photographic department later merged with the The E. and H. T. Anthony Company.

The Ansconian can trace its origin from 1855 when Edward Anthony published a journal called "Anthony's Bulletin of Photographic Invention & Improvement". This later became the famous "Anthony's Photographic Bulletin".

Subscription price is sixty cents a year. All inquiries should be addressed to Technical Product Information, Consumer Service Department, Agfa Ansco, Binghamton, New York.

A DIFFERENT KIND OF SCRAP DRIVE

Some of the scientific publications have been suggesting that while the air-wardens and junior commandos are busy piling up the nation's old metal, the scientists could be conducting a scrap drive of their own for another valuable commodity. Many a good idea, many a formula or worth-while procedure lies useless and forgotten. Perhaps it was never published. Perhaps it came out at the wrong time, when circumstances did not favor it. Some of those ideas, under present circumstances might be invaluable savers of time and material. Have you any old notes? Have you access to old photographic and scientific Journals? Search them in the light of present-day needs. Consider it a part of your war contribution to go through the scrap-heap of forgotten ideas for everything that could be of use to us now. If you turn up anything useful to biological photographers send it to our *Journal*—we will get it into circulation again. The *Journal* itself is old enough to have a scrap-heap. We will go through our old numbers, which many of our present members never received, and try to present some of the valuable ideas in a condensed form. If all of our members would do the same, with whatever work they can get hold of, original or otherwise, they could help the Association enlist in one of the important activities of this war—the Salvage Army!

Association News

12th ANNUAL CONVENTION
NEW YORK CITY

Reports: Miss Zimmer's report of the fiscal year 1941-42 was cheering. After all the year's bills had been paid, the receipts exceeded the disbursements by nearly $400.00. Larger membership and *Journal* subscription, economies in the publication of the *Journal* and a good sale of back numbers made this excess possible. Mr. Massopust's report showed that Vol. X of the *Journal* had been published at a saving of approximately $240.00 over Vol. IX, in spite of difficult conditions and rising prices.

The report of the Motion Picture Committee cannot be completed until all members' reports of new work are in, but Dr. Oscar Richards, Chairman, wrote that a list of motion pictures made by B.P.A. members would be published in the *Journal,* and that further information would be given out when available, about the progress of the American Committee on Biological and Medical Films formed last June at the meeting of the American Medical Association in Atlantic City.

Mr. C. G. Eddy reported that the questionnaires filled out by members, giving information about types of work, specialties, equipment, etc. had yielded some interesting data but a full report could not be made until the material had been studied further.

Unfinished Business: The proposed amendment to create $5.00 Sustaining Memberships (Journ. B.P.A., Vol. 10, p. 206) was put to the vote and unanimously defeated. The Directors had proposed this amendment at their 1941 Board Meeting because they felt some members wished to contribute toward the Association's activities who could not take out the $10.00 Sustaining Membership. In their 1942 meeting however, the Directors felt that present circumstances did not warrant this change in the constitution. Our $10.00 Sustaining Members are extremely valuable to us and it was deemed preferable to keep this group and if possible add more such members rather than run the risk of losing some of the group into a lower Sustaining category. A Sustaining Member who pays $10.00 dues puts as much in the Association treasury as eight regular members because he costs us only one *Journal* subscription. A Sustaining Member who paid $5.00 would be the equivalent of only three regular members. During the discussion the

help toward increased activities (albums, exhibits, etc.) which the Association derives from its Sustaining Members was stressed, and some of the members, who declared they never had really understood the term, urged that more be said about the Sustaining Member in our leaflets and *Journal.*

New Business: Mr. Schmidt read a proposed amendment to the Constitution, creating the three most recent ex-Presidents ex-officio members of the Board. The Directors formulated this amendment because they felt our present practice of electing past Presidents as Directors limited the Directorships open to newer members. This amendment will be duly published at least thirty days before the next meeting and will be voted on in 1943.

A motion was passed to reimburse Miss Shiras and Mr. Levin for expenses incurred in attending our exhibit at the A.M.A. meeting in Atlantic City.

Report of the Nominating Committee: Mrs. Lydia Eskridge Black, Chairman, read the following ticket nominated by her Committee (Messrs. Leonard Perskie and David Skelton):

President—Mr. Ferdinand Harding
Vice-President—Mr. Henry Morris
Secretary—Miss Anne Shiras
Treasurer—Miss Stella Zimmer
Directors—Mr. C. G. Eddy, Mr. Albert Levin, Dr. Arthur Proetz

SECOND BUSINESS MEETING

Election of Officers: The nominations were re-read and the motion was proposed, seconded and carried that the nominations be closed. A motion that the Secretary be instructed to cast one ballot for the entire ticket was passed unanimously. Mr. Julin yielded the Chair to Mr. Harding.

1943 Meeting Place: Mr. Reis invited the meeting to Chicago. Mr. Harding said that although the government wishes technical societies to continue to meet, conditions made it impossible to foresee the best meeting place so far ahead.

Bausch & Lomb's Letter on Mr. Anthes: Mr. Schmidt read an obituary-letter from Bausch & Lomb describing Mr. Anthes' services to that company. A member of the B.P.A. since 1934, Mr. Anthes attended the New York Chapter's organization dinner just a few days before his

death and helped enthusiastically in making plans for our Convention. The members rose and stood for a moment's silence, in his honor.

No further business was brought up and the meeting adjourned.

MICROFILM AND PHOTOPRINT COPIES OF B.P.A. JOURNALS

DID YOU KNOW that the B.P.A. *Journal* Vols. I through VIII ha e been recorded on microfilm and ours is the first scientific Journal tc have its entire issue recorded in that way? At least the American Documentation Service, the branch of Science Service which reproduces and stores published articles in the form of microfilm, knows of no other Journal that has been so recorded in its entirety. The microfilming of our *Journal* was the gift of the Pittsburgh Chapter and it is to be hoped that the Volumes following eight can also be recorded in this form.

Copies of the entire issue, or any volume, or number, or article may be ordered from the American Documentation Institute through the B.P.A. Secretary. Copies cost $14.00 for the eight volumes, ¾c for a consecutive run of five or more volumes, and 1c per page for smaller orders. If microfilm copy is not desired, enlarged photoprints are available for 10c per page.

B.P.A. EXHIBIT IN CHICAGO

When the American Academy of Ophthalmology and Otolaryngology met in Chicago this October the Chicago Chapter of the B.P.A. followed their last-year's precedent of joining in the Academy's Scientific Exhibit. The Chairman of the Exhibits, Dr. Van Alyea, allotted the B.P.A. an excellent booth, 20 feet long in a conspicuous position across the end of the exhibition hall. The entire booth was draped in blue velvet and topped with fluorescent lamps. In order to do justice to this fine set-up, the Chapter used 16 x 20 mounts, throughout, individually framed in wood and covered by glass. In each corner a case of colored transparencies was hung. Photographs of the booth taken by the Chicago Chapter's Secretary Miss Gregersen show that this treatment resulted in an exhibit that looked both distinctive and professional. We owe the American Academy thanks and the Chicago Chapter congratulations for this excellent opportunity of bringing the Association's work to the attention of the eye, ear, nose and throat specialists. The

range of work we exhibited was general as the following list of pictures shows:

"Rabbit's Ears and Rabbit's Teeth", by Julian A. Carlile.
"Vitamin A Fluorescence", Marie Elsasser.
"Gastro Intestinal Mass—Robbit", Julian A. Carlile.
"Riboflavin Deficiency", Fleischmenn Laboratories.
"What's Cookin'?" Arthur Proetz, M.D.
"Emphasis—Relief Prints", McComb.
"Cucurbita Pepo L. Pollen", Louis Paul Flory.
"Two 16 x 20 cards of wash off reliefs", Wm. Stevenson.
"Eye Pathology", A. Marfaing.
"Culture of Ciliated Epithelium Growing in Vitro", Arthur Proetz, M.D.
4 examples of Black and White prints from Kodachrome Transparencies on Kodak Autopositive paper—Albert Levin.
6 Kodachrome Prints from B.P.A. *Journal*—Paul H. Holinger (laryngoscopic work).
Mirror Laryngoscopy, Black & White enlargements from 35 mm. Kodachrome. Kodachrome by Dr. Holinger, enlargements by Maria Elsasser.
Bladder Stone—M. Clemeau.
Aspirating Needles, Lardner A. Coffey.
"Kalanchoe", Louis Paul Flory.
"Kalanchoe", Louis Paul Flory (two prints).
"Tobacco Innocu. with Polycolor and Severe etch on Physalis Peruviana", Julian Carlile.
2 shadow boxes of 3¼" x 4" Kodachrome transparencies hung at either end in the corners with the following exhibitors:
John A. Maurer, George Reis and Avis Gregersen, Dr. T. K. Lawless.

Most of these prints were taken from the 1942 Salon, first shown at our New York Convention. Others, such as Dr. Proetz's cilia prints, and much of the Chicago members' work was contributed especially for this show. The exhibit was hung on short notice and Mr. Maurer of the Chicago Chapter wrote a letter to the national members: "you, all of you, have our most sincere thanks for the way in which you supplied material for the convention. It was very fine the quick way in which material came when the OK came through."

PHOTOGRAPHY IS ESSENTIAL

An interesting editorial appears in the "Progress of Science" section of the *Scientific Monthly* for November, 1942. It is entitled "Ersatz in 1942" and speaks of the new era which appears to be opening for rubber substitutes and low-alloy steels. The last paragraph reads:

"Lest it be assumed that there are fairly satisfactory substitutes at hand or foreseen for every material now used by civilized men, one element should be mentioned that appears to be almost, if not quite, indispensable for very important purposes. It is of more importance than all the gold buried in Kentucky, than all the diamonds that are used as ornaments or the cutting points of tools. It is silver. For what is silver uniquely used? The answer is for photography, and hence indirectly for all the science and art and records and industry that depend on it. Fortunately silver is widely distributed over the surface of the earth in quantities abundant for the uses of photography."

The last sentence is cheering in that America is apparently in no danger of having her silver-supply cut off entirely. But it should not be taken to mean that the manufacture of photographic emulsions can get silver in the amounts they used to. There will be restrictions all along the line, and photographers who have not yet been pinched by them can expect to be soon, for all but the most essential purposes. As a sample, consider the W.P.B. Order 1-178, already in effect which requires anyone wishing to purchase or transfer 35 mm. motion picture film to obtain approval of the use or transfer and a certificate of authorization to do so.

NOTE: When dealers refuse to sell materials to clinical photographers because of quota restrictions, they should follow the following procedure: For any particular purchase desired—say a 30 day requirement—a PD-1A application should be filled out and sent to the W.P.B., Washington, D. C., attention: PD-1A Routing Section. Medical photography stands high in W.P.B. considerations.

B.P.A. MEMBERS IN WAR WORK

Many of our members are now engaged in war-work in Washington, or some production center, or in active service. As we wrote in the September issue, information about these transfers comes in slowly, but we are able to add a few items to the list we published then.

Mr. John Bledsoe, College of Medicine, University of Cincinnati and B.P.A. Director, is on leave of absence from the University and has

completed a twelve weeks course as Naval Radio Technician at the A. and M. College in Texas.

Mr. C. G. Eddy, Eloise Hospital, Michigan and B.P.A. Director, is now 1st Lieutenant Eddy, at the Army Medical Museum in Washington.

Mr. Lloyd Varden, Agfa Ansco Co., Binghampton and Sustaining Member B.P.A. is with the War Production Board in Washington. The W.P.B. has many Divisions, one of the most vital being the Division of Industry Operation. This Division includes the Consumers Durable Goods Branch, which in turn includes the Motion Picture and Photography Section. This section (now w're getting to Mr. Varden) has a unit known as the Photographic Films and Papers, and of this unit Mr. Varden is Chief. He works with the various departments of the military forces, the civilian supply branch, Lend-Lease, B.E.W., etc., in coordinating their photographic sensitized goods requirements with the production capacities of the manufacturers. We know these facts because, in spite of the constant complexities of his job he took time to answer our plea for information with a most satisfactory letter (other members please note).

Some of our members are still doing business at the old stands, but the business is different. New types of work are coming in, particularly in institutions that are cooperating with various military organizations. Some of this work is of course confidential, but we hope that we will begin to hear more soon about the aspects that can be told. If your job is changing, under present conditions, please let us know what you can about it.

New Members

We take pleasure in announcing the following new members:

Barzilai, Gemma, (*J. B. Haulenbeek*[4]), 68 East 86th St., New York, N. Y.
Boyle, Beatrice A., 19240 Battersea Blvd., Rocky River, Ohio.

Creskoff, Adolph J., M.D., 3400 Spruce St., Philadelphia, Pa.

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Duryee, Dr. A. Wilbur, 140 E. 54th St., New York, N. Y.

Feldman, Louis A., (*L. V. Bergman*[3]), 259 New York Ave., Brooklyn, N. Y.
Fox, Jay T., (*J. B. Haulenbeek*[5]), Seaford, L.I., New York.
Fuhr, Jacob, (*J. B. Haulenbeek*[6]), 210 East 64th St., New York, N. Y.

Gibson, H. Lou, (*Harris B. Tuttle*[1]), 343 State Street, Rochester, N. Y.
Gifford, Dr. Harold, 1620 Medical Arts, Omaha, Neb.
Glasmann, Virginia E., (*Maria Elsasser*[1]), 806 Metropolitan Bldg., Denver, Colorado.
Gugliotti, Ursula, (*G. E. H. Mathes*[1], *Louis Schmidt*[27]), 73 East Main St., Waterbury, Conn.

Haffen, Marjorie, (*J. B. Haulenbeek*[7]), 238 Madison Ave., New York, N. Y.
Hallman, E. T., (*Norman M. Nelson*[1]), Dept. of Animal Pathology, Michigan State College, E. Lansing, Mich.
Harvey, Dr. Ethel Browne, (*J. B. Haulenbeek*[8], *Oscar Richards*[9], *Louis Schmidt*[28],) Biology Department, Princeton Univ., Princeton, N. J.
Higbee, Dr. David, (*Avis Gregersen*[3]), 3245 4th Ave., San Diego, Calif.

Johnson, Hobert C., M.D., (*Avis Gregersen*[4]), 839 Belgrade, Mankato, Minn.

Katz, Dr. Albert B., 345 Wyoming Ave., Philadelphia, Pa.

Latven, Albert R., Folcroft, Pa.

Mall, Walter J., (*J. B. Haulenbeek*[9], *Louis Schmidt* [29]), Broadway, W. Norwood, N. J.
McWhirk, Miss Clara, (*J. B. Haulenbeek*[10]), Haff Hospital, Northampton, Pa.
Miller, F. G., Leoti, Kansas.

Nichtenhauser, Adolf, M.D., The American Film Center, Inc., 45 Rockefeller Plaza, New York, N. Y.
New York Orthopaedic Disp. & Hospital, Library, 420 E. 59th St., New York, N. Y.
Nushawg, William N., (*Oscar Richards*[10]), 292 Sycamore St., East Aurora, N. Y.

Ornston, Dr. Darwin Gray, 36 Carpenter Lane, Philadelphia, Pa.

Press, Morris, (*J. B. Haulenbeek*[11], *Louis Schmidt*[30]), Hummelstown, Pa.

Rathbun, George E., 1124 Buelah Ave., Los Angeles, Calif.
Renner, Dr. M. J., 1st National Bank Bldg., Goodland, Kansas.
Riser, Dr. Roy D., 120 Main St., Park Ridge, Ill.

Shaffer, Harry G., M.D., Clearfield, Pa.
Sheehan, John F., Creighton Univ., Omaha, Neb.
Shroyer, S. L., 1319 8th Ave., Beaver Falls, Pa.
Slavik, Edward F., M.D., 408 S. Spring St., Berwyn, Ill.
Smialek, Dr. J. L., 959 N. Western Avenue, Chicago, Ill.
Solberg, Archie, (*Dr. Daniel R. Barr*[1]), Dept. of Biology, University of Toledo, Toledo, Ohio.
Stanley, Miss Phyllis, 27 S. 9th St., Newark, N. J.
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Traugott, Felix, 47 Duncan Ave., Jersey City, N. J.

Waller, C., Research Lab., Ilford Ltd., Ilford, Essex, England.
Weber, Julius, (*J. B. Haulenbeek*[12]), 694 Schenck Ave., Brooklyn, N. Y.
Whitney, Dr. Edward T., 587 Brown Street, Boston, Mass.
Winnek, Douglas F., (*F. R. Harding*[6], *Louis Schmidt*[31]), 106 Haven Avenue, Mt. Vernon, N. Y.
Wolf, Dr. William, 1192 Park Avenue, New York, N. Y.

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EDITOR

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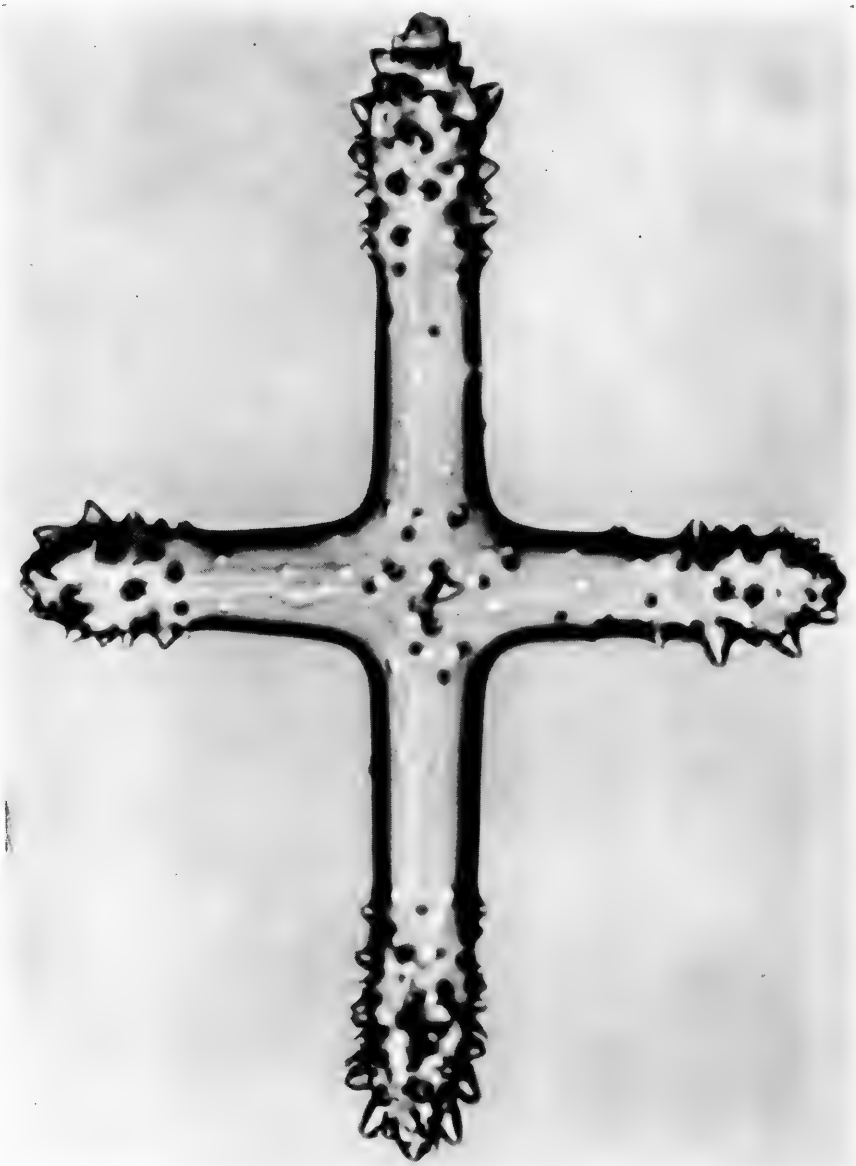

Photomicrograph of a spicula of a sponge. Carbon arc illumination, D. C. Ortho plate, Wratten B filter. Photographed by Leo C. Massopust.

In Hoc Signo Vinces

In This Sign Thou Shalt Conquer

by Anthony F. Berens S. J.*

THE deeper we delve into the secrets of nature the more marvelous and consistent do we find her, and what wonder since nature and nature's laws are but the thoughts of the Creator ruling the universe. As the Sistine Chapel records the aspirations of Michaelangelo and the Athena embodies the mind of Phidias and the radio expresses the dreams of Marconi, a sunset at Niagara, this cruciform spicula of a sponge reveals the orderly mind of the God of creation.

This spicula of a sponge suggests, too, the perfect compatibility of religion and science. The spicula is from God and the cross is from God, and they do not in the least conflict. Science strives to unfold the workings of nature and expresses her findings in what she calls the laws of nature. These laws are man's expression of God's plan for the interaction of material substances and forces. Or more simply, science tries to discover the plan of the universe which God has planned. Religion strives to learn the laws which govern spiritual substances, God and other spirits and the interaction of these spirits upon one another. These laws which govern the interaction of spirits, especially as regards their relationship to their creator, are God's plan for the spiritual realm. The infinite mind of God cannot be in conflict with itself. As a consequence His laws for the material realm, which we call science cannot be at variance with His laws for the spiritual realm which we call religion. Men of science may be in disagreement with men of religion but only when either or both are mistaken. Theories of science, which are conjectures of God's plan for material things may conflict with facts of religion, which are correct statements of God's thoughts for things of the spirit; or theories of religion, which are conjectures of God's thoughts for things spiritual, may conflict with facts of science—true statements of God's thoughts on things material. But facts of science never can conflict with facts of religion, since both of these are correct statements of God's plan for these respective spheres.

* Regent of Marquette University School of Medicine, Milwaukee, Wisconsin.
Received for publication February 10, 1943.

Medical Art and Photography Enlist for the Duration

ARMY

IN a previous issue of this Journal[1] notice was given that the Medical Arts Service had been activated at the Army Medical Museum. This Service was described as consisting of artists and photographers grouped into mobile units for overseas duty. Each unit consists of seven men, all professional artists and clinical photographers. One of the seven will in each case be a Sanitary Corps Officer with broad training and experience in medical illustration.

These units will make a graphic record of the wounds and diseases incident to warfare, and the results of specific treatments. Photography, cinematography, drawings, paintings and moulages will all be used as illustrative media. Furthermore, missiles, weapons, protective devices and pathological material will be collected by the units to amplify the illustrative material being shipped back to the Army Medical Museum. After the material has been integrated at the Museum it will be generally available for distribution to teaching centers.

This unified program marks a real advance in the Army's appreciation of visual education. Units of illustrators, trained, equipped and acting under their own officers were unheard of in World War I. In fact it was not until May 1918 that the Medical Department had the official right to practice photography at all. Up to that time the only recognized photographers were in the Signal Corps.

CIVILIAN

Not all the casualties induced by war are suffered at the front. Many wounds, infections and injuries are seen by civilian doctors. The Army is interested in these casualties wherever they occur, but has no organization for obtaining them in this country. On December 29, 1941 the Subcommittee on Historical Records of the Advisory Committee of the

[1] Vol. X, No. 3, March, 1942, p. 145.

National Research Council discussed "the importance of a museum development to deal with modern war-wounds, service and civilian" and voted to request the Chairman of the International Association of Medical Museums to begin collecting material, and to plant for its preservation. The Council of the Museums Association and the Secretaries of the American Association of Pathologists and Bacteriologists, and of the American Society of Clinical Pathologists agreed to cooperate, and each of their members received a letter from Col. Ash who is Secretary-Treasurer of the Museums Association and Curator of the Army Medical Museum. His letter outlined the type of material needed, emphasized

> The Museum and Medical Arts Service is anxious to know about any medical photographers who are already in the army or subject to draft. An effort will be made to have them transferred to a branch of the Service where their special services will be available to the Medical Department.

the value of photographic recording of wounds and their treatment, and the conditions under which it could be shipped to the Medical Museum.

The Pathologists therefore have heard of the Museum project in some detail. It is fitting that they should be the organizers as pathological specimens accompanied by complete clinical data and autopsy protocols are among the main items needed. However some types of wounds such as burns, infections, industrial and even aviation injuries could be treated in a hospital without ever coming to the pathologist's attention. It is important therefore that knowledge of the type of material needed should be widespread through the institution. Anyone who is known to make medical pictures might be called upon by the attending physician to record the course of treatment, and so we want photographers to realize that material so recorded may have a wider field than use in their own institutions. Injuries or illness caused by airplane crashes, sabotage, civilian bombings, fires, gunshot wounds and specific epidemics, particularly the virus diseases, encephalitis, polio, Rickettsia, influenza and atypical pneumonia are of interest to the Army Medical Museum, and any illustrative matter of these conditions and

their treatment, if accompanied by complete clinical data, may be nationally useful. Contributors would be credited in the Museum files and would not lose control of their material. Prints will be accepted, but negatives are more useful and may be sent in any sizes.

Remember the Army Medical Museum whenever you photograph material in the above categories. It should be sent to the Curator of the Army Medical Museum, Washington, D. C.

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Photographic Processing Control

by Louis Paul Flory*

Part I

I. Introduction

PROCESSING CONTROL is essential to the production of quality where production entails chemical methods. This is particularly true of photography. Uncontrolled methods can produce only haphazard results with a consequent waste of material and labor.

The motion picture industry, dealing as it does with large amounts of sensitive material and large volumes of solutions, has been forced to use processing control to the widest extent. Control of picture and sound quality is of great economic importance because of the production volume and the amount of money involved. Control of waste of material and labor is essential.

The development and printing of motion picture film is usually a continuous process in which production may be measured in millions of feet of film per week. Such a continuous process lends itself to processing control without much difficulty. The question is whether the biological photographic laboratory, with its much smaller production volume of an intermittent nature (usually still photographs on separate sheets of film and paper), can utilize processing control with any degree of efficiency, and whether it is of any practical importance in such work.

In biological photography, the photographic problem usually has as its end result the production of a positive in which the subject is faithfully reproduced, or in which some parts of the subject are emphasized with respect to others. The quality of the positive is judged subjectively, and the judging implies a knowledge of the limitations of the positive material.

The choice of the positive material will depend upon such factors as: material available; surface characteristics; weight of paper stock; projection or contact printing; photomechanical process to be used if the photograph is to be reproduced by such means; exposure scale. The exposure scale of the positive material is of great importance, for it will determine

* From the Boyce Thompson Institute for Plant Research, Yonkers, New York.
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the contrast (gamma) to which the negative should be developed for a specific type of subject.

An efficiency factor also becomes part of the printing problem. Usually there is a definite negative density—in the most important part of the negative—which will permit the printing apparatus to be used with the greatest efficiency with respect to the printing-exposure time. An exposure time less than 2 seconds may not allow of sufficient control, while an exposure time greater than 10 seconds will slow down the printer production. This factor is directly related to the printing lamp intensity. Obviously, the printing lamp intensity must be sufficient to permit a reasonable printing-exposure time when printing a correctly exposed negative. The specifications of a correctly exposed negative are open to some debate, and will depend somewhat upon the type of subject. It is assumed that the negative exposure is such as to utilize some part, if not all, of the straight-line portion of the characteristic curve of the negative emulsion. The choice of a specific density for the most important part of the negative will depend upon the over-all negative exposure, and upon the type of subject. The relation between negative gamma, exposure scale of the positive material, over-all exposure of the negative, and the choice of a specific negative density will be discussed in another section. It is sufficient, for the time being, to point out that all these factors are interdependent.

The use of photographic processing control implies a knowledge of the results desired and the methods necessary to achieve those results. If the above factors can be determined, additional experimentation will disclose the methods.

Most photographers use some form of processing control, if only the control of development time and temperature. The control of negative density and gamma, while more complex, is not beyond the capability of the biological photographer. Processing control, however, can do more than this. It can control the exhaustion point of developers, stop baths, and fixing baths. The control of these factors is also essential to the maintenance of quality.

Waste of material and labor should be kept at the minimum commensurate with a practical degree of efficiency. Processing control will, in the end, produce a greater over-all efficiency and keep production up to a satisfactory level of quality. The photographer must decide the extent to which it can be adapted to his needs and his specific processing conditions.

Photographic processing control may be divided into two parts: sensitometric control; chemical control. Sensitometric control establishes the tolerances which must be met by chemical control.

II. Sensitometric Control

Before sensitometric values can be used as control factors, the behavior of the specific emulsion with the specific developer must be known. It is the function of sensitometry to determine these values. The following information must be obtained by experimentation:

A. Characteristic curves for the specific emulsion with the specific developer, at the working temperature, for different periods of development time.

B. Time-gamma curve for the most useful working temperature.

C. Time-temperature curves for the most useful gammas.

D. Intercept-gamma curve for the most useful temperature, and an iso-density curve.

A. Characteristic Curves

Fig. 1 shows the usual characteristic curve, or D-Log_{10}E curve, with densities plotted as ordinates, and Log_{10} of exposure, in meter-candle-seconds, plotted as abscissas. The equation of the straight-line portion of the curve is:

$$D_n = \gamma Log_{10} E/E_i \qquad (1)$$

where: D_n = negative density; γ = gamma, or the tangent of the angle Θ; E = exposure; E_i = exposure value at the intercept of the straight-line portion of the curve with the abscissa axis.

The construction of such a curve necessitates the use of an elaborate instrument, capable of exact control of time and intensity. Most of these instruments have been constructed on the time-scale basis, where the time of exposure is varied at a constant intensity. Most photographs are made on an intensity-scale basis, where the exposure time is constant (for a specific negative) and the intensity of the light reaching the image plane, hence the emulsion, depends upon the amount of light reflected from the different parts of the subject. An instrument designed on this basis is known as an intensity-scale sensitometer, while that designed on the former basis is known as a time-scale sensitometer. While the time-scale sensitometers constructed up to this time are usually more accurate than the intensity-scale sensitometers, the latter type are much simpler in construction—in fact an extremely simple type was used in obtaining the data from which the curves in this article were constructed. The intensity-scale instrument used was the large size Eastman Gray Scales, calibrated in reflection density units. These calibrated gray scales can be purchased for a nominal sum.

If such a gray scale is photographed, using the usual type of illumination, the resulting negative will show a series of densities which bear a

definite relation to the gray scale densities, for a specific development procedure. If these negative densities are measured on a transmission densitometer, and plotted as ordinates with the reflection densities of the gray scale as abscissas, on rectangular coordinate paper, a curve similar to Fig. 2 will result. The equation of the straight line in this case is:

$$D_n = -\gamma D_s + b \qquad (2)$$

where: D_n = negative density; γ = gamma, or the tangent of the angle Θ; D_s = gray scale density; b = value of the intercept of the straight line on the ordinate axis.

If it is assumed that the curves shown in Fig. 1 and Fig. 2 are constructed on an intensity-scale basis, it can be shown that the first derivative of each equation with respect to $\mathrm{Log_{10}I}$, where I represents intensity in meter-candle-seconds, is equal to gamma. The use of the Eastman Gray Scales, therefore, is justified in determining gamma.

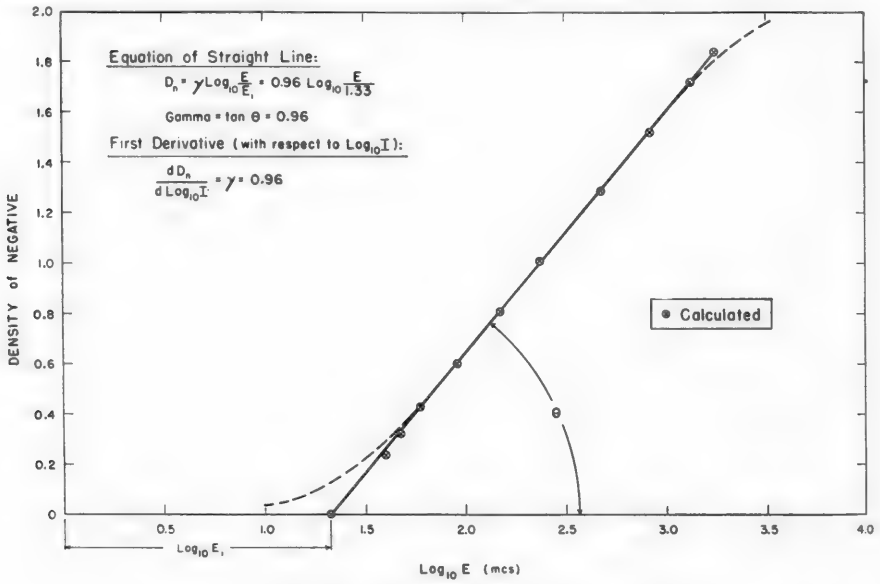


Fig. 1. Typical characteristic, or D-log$_{10}$E, curve.

Six photographs of a calibrated gray scale were made and developed in Glycin developer for the development times shown in Fig. 3. The negative densities of each negative were measured on a National Photocolor densitometer. The negative densities of each negative were plotted against the gray scale densities, giving the family of curves shown in Fig. 3, for the temperature of 68°F. It should be noted that each curve is not a

straight line throughout its entire length—in the higher negative densities representing the lower gray scale densities. The most probable straight line passing through the plotted points was calculated using the method of least squares, neglecting those points which obviously would not fall on a straight line.* The value of gamma for the most probable straight-line portion of each curve results from this computation. This method of computing gamma, because of its greater accuracy, is to be preferred to that of measuring the angle Θ with a protractor, and obtaining the tangent from tables.

B. Time-gamma Curves

The same procedure was repeated for the temperatures of 61°F. and 76°F. The resulting gammas for the three temperatures were plotted as ordinates with development time as abscissas on rectangular coordinate paper; Fig. 4.

C. Time-temperature Curves

Values of development time were plotted as ordinates with temperatures as abscissas on semi-logarithmic paper for three useful values of gamma; Fig. 5.

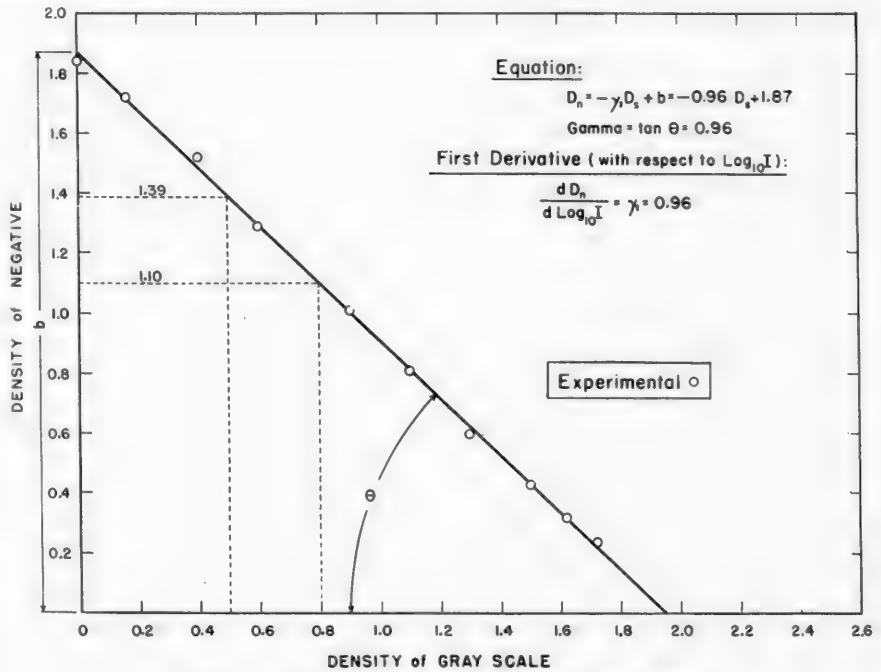


Fig. 2. D_n-D_s curve, using Eastman Gray Scales.

* See Appendix A.

D. Intercept-gamma Curve, and Iso-density Curve

The D_n-axis intercepts (b) of the straight lines in Fig. 3 were plotted as ordinates with the corresponding values of gamma as abscissas on rectangular coordinate paper. The result is shown in the left-hand portion of Fig. 6. The most probable straight line passing through the plotted points was calculated by the method of least squares. The specific equation for the line is:

$$b = 1.93\gamma + 0.10 \qquad (3)$$

An additional curve, of limited use, was plotted in the right-hand portion of the graph. This is an iso-density curve for the negative density

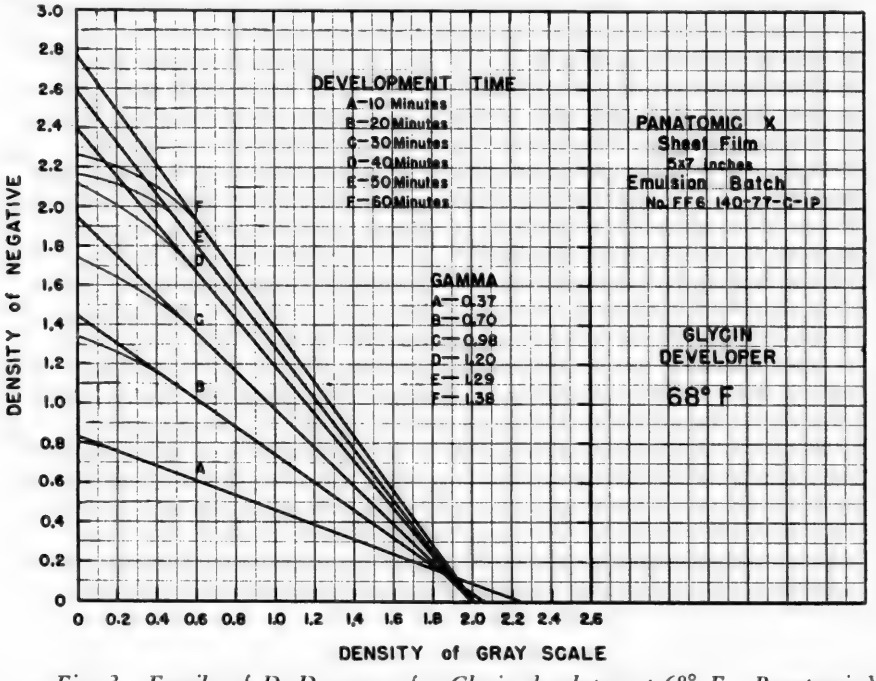


Fig. 3. Family of D_n-D_s curves for Glycin developer at 68° F. Panatomic-X sheet film.

of 1.0. The ordinates are values of D_s from Fig. 3, and the abscissas are values of gamma.

All the data necessary for the use of sensitometry in photographic processing control are contained in the above graphs. Its application, of course, is limited to the specific emulsion and emulsion batch, as well as the specific developer; and in the case of Fig. 6, to the specific temperature of 68°F. This temperature is recommended by the manufacturers of sensi-

tive material as the most suitable for the development of both negatives and positives. It is assumed that a temperature control method will prevent a variation greater than $\pm 0.5°F$, at least during the period of development. If a different working temperature is used, graphs similar to Fig. 3 and Fig. 6 must be constructed for that temperature.

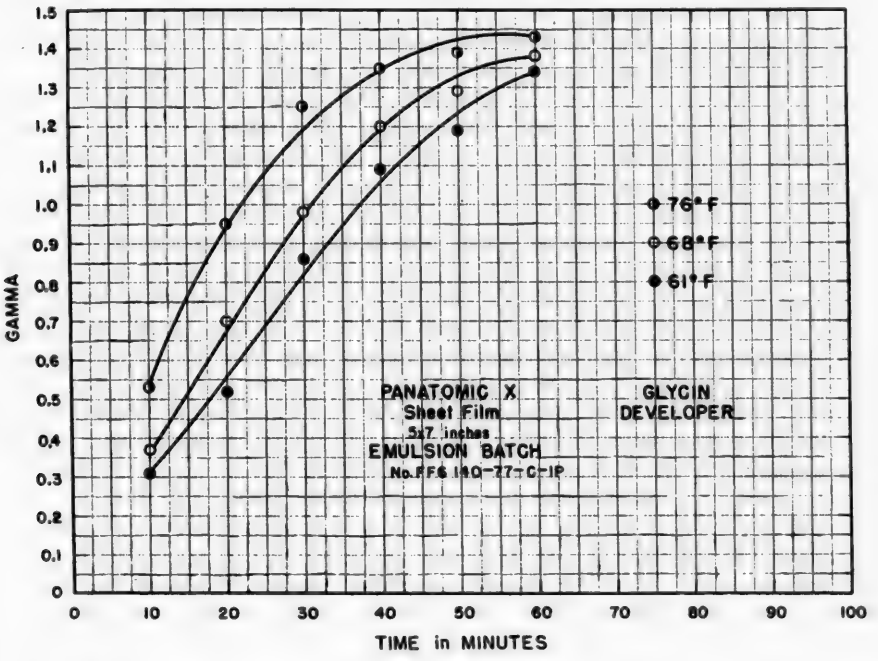


Fig. 4. Time-gamma curves for 61° F., 68° F., and 76° F. Glycin developer. Panatomic-X sheet film.

To put the information obtained into use as a method of processing control, it will be necessary to consider the relation of negative exposure and development.

E. Exposure Problem

Negative exposure and development are so closely allied and interdependent that it is impossible to consider one without the other. Exposure determines the densities produced in the negative or positive. The extent of development determines the density differences, and the gamma, as shown in Fig. 3. In considering gamma for the purposes of this part of the discussion, it will be assumed that the brightness values of the subject photographed—so far, the gray scales—will remain constant,

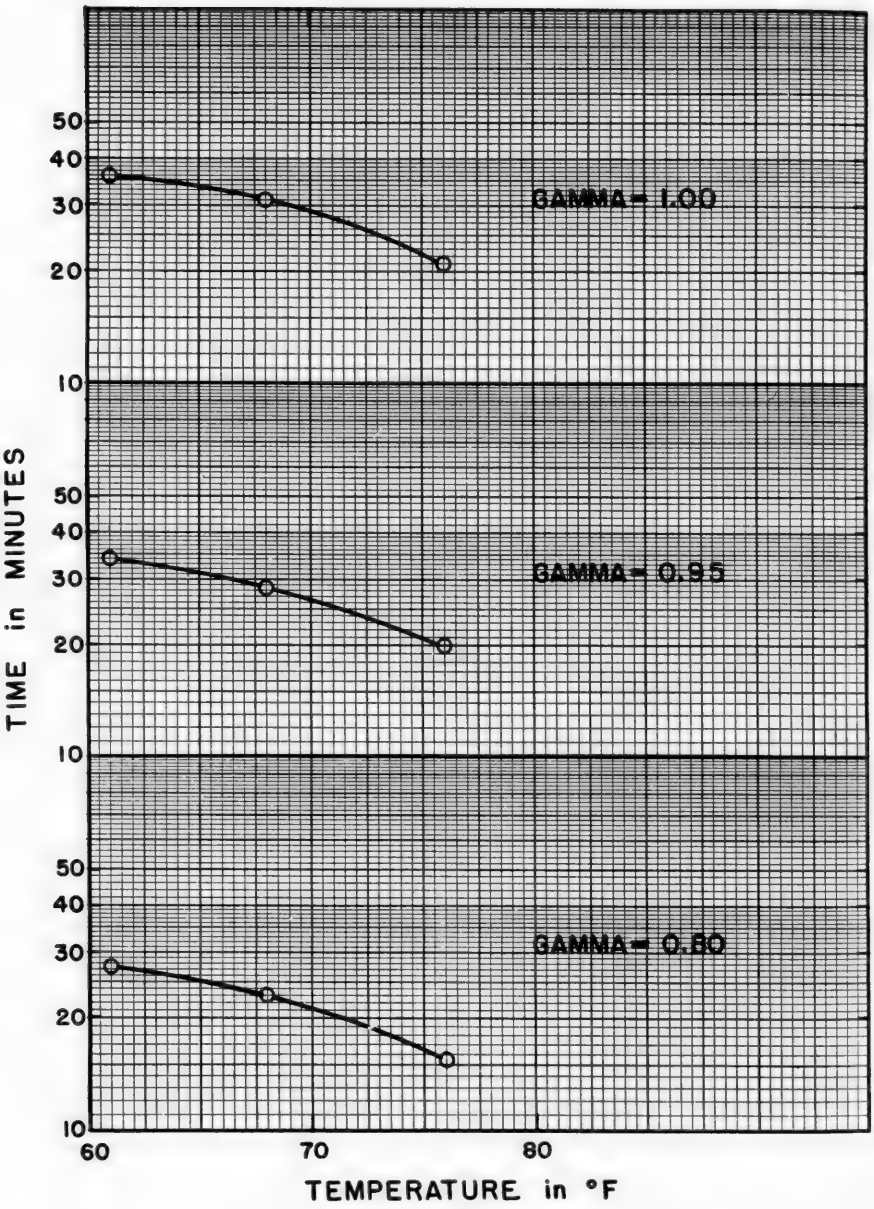


Fig. 5. Time-temperature curves for gammas of 0.80, 0.95, and 1.00. Glycin developer. Panatomic-X sheet film.

and that development contrast (gamma) depends upon the extent of development, temperature of the developer, and the developer formula.

The author, in a previous article[1], pointed out that published film speeds, time-temperature curves, and time-gamma curves can be used only when the processing conditions used by the manufacturer in determining these factors are reproducible in practice. This is seldom the case, and the author described a method of computing film speeds for specific processing conditions. This method** is applicable only where the desired value of gamma is known, and where it is held constant.

In discussing film speed, it must be noted that there are a number of methods of determining such a factor, and that some debate exists concerning the validity of the different criteria. It is not the purpose of the author to decide this question, but it must be stated that the following mathematical devices are based upon the assumption that the "film speed number" is inversely proportional to the exposure required to produce a given density for specified processing conditions. The author also feels that the intelligent use of a good exposure meter is *sine qua non* to successful exposure and processing control.

In making the negatives of the gray scale for the purpose of obtaining information such as is shown in Fig. 3, the actual construction of the curves will show, by the departure from the straight-line relationship, whether the over-all exposure was normal. Overexposure or underexposure will be shown by the shape of the extremities of a free-hand curve drawn through the plotted points. The shape of the curve will, of course, depend upon the type of negative emulsion, and the type of developer.

The density chosen for the most important part of the negative, hereafter called the desired density, should fall on some part of the straight-line portion of the curve. Just where it should fall will depend upon the film speed system used; but this need not cause concern, as the equations which follow express a relationship between film speeds, and are applicable to any system which complies with the limitation mentioned above.

If the desired density and the desired gamma are known, processing control can be used to hold these factors within certain prescribed limits.

The problem at this point is to determine what film speed should be used to produce the desired density at a gamma dependent upon the exposure scale of the positive material. If this gamma is equal to the

[1] Flory, Louis Paul: "Calculation of Film Speeds for Specific Processing Conditions." Photo Technique, Vol. 3 (August, 1941), No. 8, pp. 54-56.

** Described in abstract form in Appendix B.

gamma of one of the family of curves in Fig. 3, the problem is relatively simple. If there is no $D_n - D_s$ curve for the desired gamma, but if there is an iso-density curve for the desired density, such as that shown in the

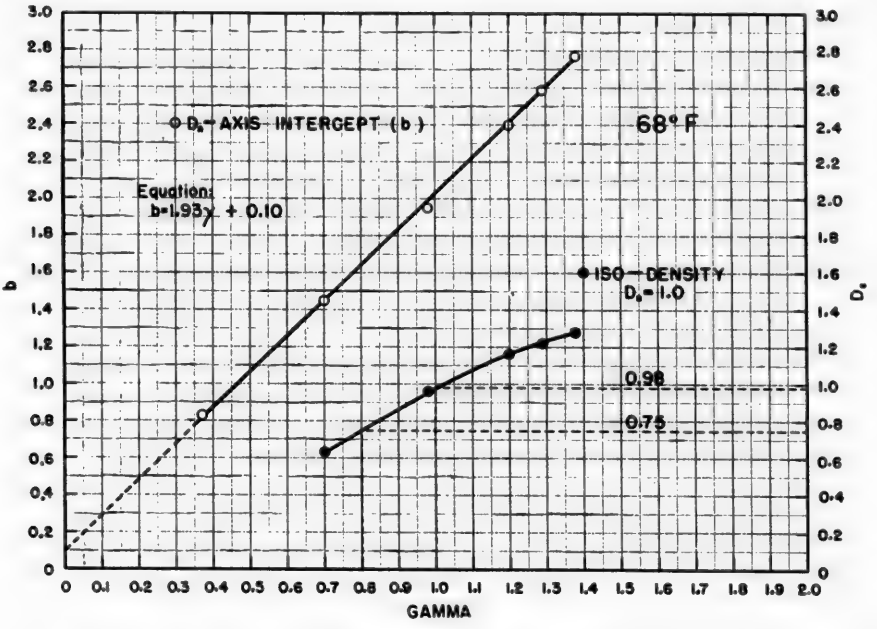


Fig. 6. D_n-axis intercept curve, and Iso-density curve for D_n=1.00. Glycin developer at 68° F. Panatomic-X sheet film.

right-hand portion of Fig. 6, the problem can still be easily solved. If there is neither a $D_n - D_s$ curve nor an iso-density curve, the problem becomes more complex.

Case 1

Assume that the curve in Fig. 2 represents an actual curve, and that the slope of the straight-line represents the desired gamma. Assume that a target*** has been photographed, the negative developed to a gamma corresponding to that of the curve in Fig. 2 (0.96), and that the density of the negative has been measured and found to be 1.39. Assume a desired density of 1.10. On Fig. 2, draw lines parallel to the D_s axis through each of the two densities on the D_n axis. At the points of intersection of these two lines with the $D_n - D_s$ curve, drop perpendiculars to the D_s axis. This construction is shown by dotted lines in Fig. 2. The perpendiculars intersect the D_s axis at the points: $D_s = 0.50$; $D_s = 0.80$.

*** See Appendix B.

Let: S_{n1} = film speed used in making the negative; assume this value to be 16.

S_{n2} = film speed which will produce the desired density.

D_{s1} = gray scale density corresponding to the negative density of 1.39; equal to 0.50.

D_{s2} = gray scale density corresponding to the negative density of 1.10; equal to 0.80.

The equation to be used in this case is:

$$S_{n2} = \text{antilog}_{10}(D_{s2} - D_{s1}) \cdot S_{n1} \qquad (4)\ ****$$

therefore:

$$S_{n2} = \text{antilog}_{10}(0.80 - 0.50) \cdot 16$$

and:

$$S_{n2} = 2 \cdot 16 = 32.$$

Had the negative produced a density of 1.10, and had the desired density been 1.39; then $D_{s1} = 0.80$, and $D_{s2} = 0.50$. In this case, in order to avoid the use of negative logarithms, use would be made of the following equations:

$$S_{n2} = S_{n1} / \text{antilog}_{10}(D_{s1} - D_{s2}) \qquad (5)$$

therefore:

$$S_{n2} = 16 / \text{antilog}_{10}(0.80 - 0.50)$$

and:

$$S_{n2} = 16 / 2 = 8.$$

Equation (4) should be used when $D_{s2} > D_{s1}$; equation (5) when $D_{s1} > D_{s2}$.

Case 2

Assume that because of some difference in the brightness range of the subject, it is desired to develop the negative to a lower gamma to fit the density scale of the negative to the exposure scale of the positive material. Also assume that the desired negative density is 1.0, and that an iso-density curve for the density of 1.0, as shown in Fig. 6, is available. Assume that a film speed of 16 produces a negative density of 1.0 when developed to a gamma of 1.0; that it is desired to produce a negative density of 1.0 at a gamma of 0.80; that a $D_n - D_s$ curve for the gamma of 0.80 does not exist. From the iso-density curve in Fig. 6, it is simple to find the corresponding values of D_s. The dotted lines show the construction. Use would be made of equation (5), and the computation would be:

$$S_{n2} = 16 / \text{antilog}_{10}\,(0.98 - 0.75)$$

$$S_{n2} = 16 / \text{antilog}_{10}\,0.23 = 16 / 1.7 = 9.4.$$

**** For derivation of equation (4) see Appendix C.

CASE 3

Assume that there is neither a $D_n - D_s$ curve for the desired gamma, nor an iso-density curve for the desired negative density; that it is desired to develop the negative to a gamma lower than that for which there is a $D_n - D_s$ curve available, but that the desired density is to be the same in both cases. Assume the following to be known:

$$S_{n1} = 16;\ D_{n1} = D_{n2} = 1.20;\ \gamma_1 = 0.98;\ \gamma_2 = 0.85.$$

It is possible to solve this problem by graphical construction on the family of curves in Fig. 3. A straight line is drawn through the point of intersection of the family of curves, at a slope (tangent of the angle Θ) equal to the desired gamma (0.85). From the intersection point of this straight line with a line drawn parallel to the D_s axis through the density $D_{n1} = D_{n2} = 1.20$, a perpendicular is dropped to the D_s axis, and the value of D_{s2} found by this construction. This method is open to the objection of possible inaccuracy in laying out the angle Θ, and the difficulty in determining the intersection point of the family of curves, as well as other errors that may occur in construction. Also, the values of D_{s1}, b_1, and b_2 should be computed rather than read from the curves. The computation of D_{s1} and D_{s2}, while somewhat involved, takes little more time than would be taken by graphical construction, and is much to be preferred. In order to compute the values of D_{s1} and D_{s2}, recourse must be had to the intercept-gamma curve shown in the left-hand portion of Fig. 6. The steps necessary are as follows:

Step 1. Calculate the values of b_1 and b_2 from equation (3):

$$b_1 = 1.93 \cdot 0.98 + 0.10 = 1.99$$
$$b_2 = 1.93 \cdot 0.85 + 0.10 = 1.74$$

Step 2. Substitute these values, together with the values of D_{n1} and D_{n2} in equation (2), and solve for D_{s1} and D_{s2}:

$$1.20 = -0.98 \cdot D_{s1} + 1.99$$
$$D_{s1} = 0.806.$$
$$1.20 = -0.85 \cdot D_{s2} + 1.74$$
$$D_{s2} = 0.635.$$

Step 3. As $D_{s1} > D_{s2}$, substitute these values in equation (5):

$$S_{n2} = 16 / \text{antilog}_{10}\,(0.806 - 0.635)$$
$$S_{n2} = 16 / 1.48 = 10.8.$$

The value of D_{s2} may be calculated without first calculating the value of b_2 by the use of the following equation:

$$D_{s2} = \frac{\gamma_1 D_{s1} + 1.93(\gamma_2 - \gamma_1)}{\gamma_2} \qquad (7)$$

The use of equation (7), however, is limited to the case where $D_{n1} = D_{n2}$.

Case 4

Assume that there is neither a $D_n - D_s$ curve for the desired gamma, nor an iso-density curve for the desired density; that it is desired to change not only the gamma, but the desired density. The problem can still be solved by the use of equation (4) or (5). The reason for this is that neither equation contains the factors of gamma nor D_n, and is only concerned with values of D_s. Although in this case D_{n1} is not equal to D_{n2}, proceed to calculate the values of D_{s1} and D_{s2} as in steps 1, 2, and 3 of Case 3. Assume the following to be known: $S_{n1}=16$; $D_{n1}=1.20$; $D_{n2}=0.90$; $\gamma_1=0.98$; $\gamma_2=0.75$.

Step 1. Calculate the values of b_1 and b_2 from equation (3):

$$b_1=1.93\cdot 0.98+0.10=1.99$$
$$b_2=1.93\cdot 0.75+0.10=1.55$$

Step 2. Substitute these values, together with the values of D_{n1} and D_{n2} in equation (2), and solve for D_{s1} and D_{s2}:

$$1.20=-0.98\cdot D_{s1}+1.99$$
$$D_{s1}=0.806.$$
$$0.90=-0.75\cdot D_{s2}+1.55$$
$$D_{s2}=0.866.$$

Step 3. Substitute these values in equation (4), as $D_{s2}>D_{s1}$:

$$S_{n2}=\text{antilog}_{10}\,(0.866-0.806)\cdot 16$$
$$S_{n2}=1.15\cdot 16=24.$$

A table of antilogarithms to the base 10 is most convenient in the use of equations (4) and (5). If such a table is not available, the usual table of logarithms to the base 10 may be used. A good slide rule is usually sufficiently accurate, in skillful hands, for such purposes.

The calculations involved in the computation of S_{n2} in Cases 1, 2, 3, and 4 may seem to be laborious, but the total time consumed in making the calculations in Case 4 (most involved case) was only 5 minutes. This compares favorably with the time consumed by a graphical method, and has the advantage of much greater accuracy.

III. Reproducibility, and Accuracy of Results

Little can be accomplished by photographic processing control unless the results of sensitometric control are reproducible within limits. The use of sensitometric data is based upon the assumption that a constant developer activity will be maintained. The control of developer activity is a function of chemical control and will be discussed in a following section.

Reproducibility of results depends upon not only the care with which the physical measurements are made, but to a certain extent upon the

type of apparatus used in making the measurements. The National Photocolor densitometer used to measure density in this laboratory is calibrated in steps of 0.02, and steps of 0.01 may be estimated without difficulty. Repeating the measurements a number of times and taking the arithmetical mean is usually a safe method of avoiding reading errors.

The author has computed that the *maximum probable error* could be as high as 17 per cent in the production of a desired density of 1.0 at a gamma of 0.96, under conditions existing in this laboratory. This would defeat the purpose of photographic processing control. It is unlikely that such an error would be produced in practice, as it would require an unusually unfortunate set of conditions. It does show, however, that great care must be taken in making all measurements and computations.

One of the frequent sources of error is in the use of an exposure meter to measure the brightness of the reflected illumination and to compute the exposure time. In biological photography, it often happens that the size of the subject is such that it does not occupy all of the acceptance angle of the meter. Fig. 7 shows a set-up—typical in this laboratory. Of the total area shown in the photograph, the plants occupy approximately 15 per cent, while 85 per cent is black background. The use of an exposure meter from the camera position is obviously impossible. Even if the reading is taken directly from the plants, the leaves are so small that

Fig. 7. Typical studio set-up. Plants occupy approximately 15 per cent, and the black background 85 per cent of the total area of the photograph.

such a reading would include an appreciable amount of background. Consequently, the reading would be too low, and the plants would be overexposed in the negative. When this is the case, a target***** can be substituted for the subject. Haskell[2], Cobb and Lowe[3] suggest types of targets. A green blotter, 18 inches square, is used as a target for most plant work in this laboratory. It is placed in the subject plane, and the measurement made, holding the exposure meter approximately 1 foot from the center of the target. The film speed, S_{n_2}, computed on this basis will, of course, be accurate for only the particular type of plant used when determining the film speed. It may be necessary to determine film speeds for a number of types of subjects. The same color blotter may be used, if the color approximates that of the subject. If the color of the subject differs from that of the target to any great degree, two things may happen: (1) the negative may be underexposed or overexposed, depending upon the spectral sensitivity of the emulsion; (2) the gamma may vary from that desired because of the possible variation of gamma with the wave-length of the incident radiation.

Where a linear relationship exists between two factors, and the equation of the straight line is computed by the method of least squares, the computed curve represents only the most probable position of the straight line on the graph, and some of the experimental points may not lie on the curve. In the interest of accuracy, as mentioned in Section II, E, Case 3, it is preferable to compute the values of b_1 and b_2 rather than to read them from the intercept-gamma curve. The chief value of this curve is in determining equation (3) from which the values of b_1 and b_2 can be computed. For the same reason, it would be better to compute the value of D_{s_1} from equation (2), rather than to read the value from the $D_n - D_s$ curve as shown in Section II, A, Case 1.

If the values of different factors are to be read from working curves such as are shown in Figs. 3, 4, 5, and 6, instead of being computed, the scales of abscissas and ordinates should be so chosen that the smallest subdivision corresponds with the accuracy of the data. In Fig. 3, for instance, each subdivision equals 0.10 density units. This corresponds with the calibration of the densitometer used to measure density. If a finer scale were chosen, the impression of greater accuracy would not be justified by the accuracy of the data. Plotting the graph to a coarser scale would sacrifice accuracy.

In making the photographs of the gray scales (Section II, A) the exposure time and intensity of the illumination should be approximately

***** See Appendix B.

[2] Haskell, Dudley: "Kodachrome Exposure." Camera Craft. Vol. XLV (March, 1938), No. 3, pp. 110-121.

[3] Cobb, R. M. K. and D. V. Lowe: "The Neutrowe Gray Exposure Aid." Photo Technique. Vol. 2 (September, 1940), No. 9, pp. 19-23.

that which would be used in practice for the type of subject for which the film speed is being determined. This procedure will compensate for any effect from the failure of the reciprocity law[4]. If this is not done, and there is any great change in intensity, requiring a much different exposure time, the desired density might not be obtained. The illumination in studio photography can usually be controlled, but in photomicrography the effect of the reciprocity-law failure may become serious unless precautions are taken to avoid it.

[4] Jones, L. A. and J. H. Webb: "Reciprocity Law Failure in Photographic Exposures." Journal of the Society of Motion Picture Engineers. Vol. XXIII (September, 1934), No. 3, pp. 142-159.

Appendix A. Method of Least Squares

Referring to Fig. 2, the equation of the straight line is: $D_n = -\gamma D_s + b$. The problem is to compute the value of γ and b. The following example and the formulae show how this is done. A table should be prepared as follows:

D_s	D_n	(D_sD_n)	$(D_s)^2$
0.60	1.29	0.77	0.36
0.90	1.01	0.91	0.81
1.10	0.81	0.89	1.21
1.30	0.60	0.78	1.69
1.50	0.43	0.65	2.25
1.62	0.32	0.52	2.62
1.72	0.24	0.41	2.95
8.74	4.70	4.93	11.89

Therefore:

$$\Sigma D_s = 8.74$$
$$\Sigma D_n = 4.70$$
$$\Sigma(D_sD_n) = 4.93$$
$$\Sigma(D_s)^2 = 11.89$$

Now:

$$\gamma = \frac{\Sigma D_s \Sigma D_n - N\Sigma(D_sD_n)}{N\Sigma(D_s)^2 - (\Sigma D_s)^2}$$

and:

$$b = \frac{\Sigma D_s \Sigma(D_sD_n) - \Sigma D_n \Sigma(D_s)^2}{(\Sigma D_s)^2 - N\Sigma(D_s)^2}$$

where N = the number of observations. (Note that the first three points, where D_s equals 0.0, 0.16, and 0.40, were omitted from the calculations. This was done because it was felt that they might not fall on the most probable straight line. Fig. 2 shows, however, that they are not far from the straight line.)

Therefore:

$$\gamma = \frac{8.74 \cdot 4.70 - 7 \cdot 4.93}{7 \cdot 11.89 - 8.74 \cdot 8.74}$$

$$\gamma = \frac{6.57}{6.84} = 0.96$$

and:

$$b = \frac{8.74 \cdot 4.93 - 4.70 \cdot 11.89}{8.74 \cdot 8.74 - 7 \cdot 11.89}$$

$$b = \frac{-12.79}{-6.84} = 1.87$$

These values are substituted in the equation giving: $D_n = -0.96D_s + 1.87$.

From this equation, the value of the D_s intercept is calculated—when $D_n = 0.0$, $D_s = 1.95$. As b equals the value of D_n when $D_s = 0.0$, the two intercepts give the position of the straight line without laying out the slope (γ). This not only saves time, but gives greater accuracy.

Appendix B. Film Speed Equation for Constant Gamma

If the value of the negative gamma is known, and if it is a satisfactory value with respect to the exposure scale of the positive material, the problem of computing the film speed necessary to obtain the desired negative density is simplified. All the information may be obtained from a single test negative developed to the known gamma. A transmission densitometer must be used to measure the negative densities.

Let: Sn_1 = film speed used in making the test negative; usually the published film speed.
Sn_2 = film speed which will give the desired density.
Dn_1 = density of the test negative.
Dn_2 = desired density.
γ = negative gamma.

Then: where $Dn_2 > Dn_1$,

$$Sn_2 = \frac{Sn_1}{\text{antilog}_{10}\left(\frac{Dn_2 - Dn_1}{\gamma}\right)}$$

Or: where $Dn_1 > Dn_2$,

$$Sn_2 = \text{antilog}_{10}\left(\frac{Dn_1 - Dn_2}{\gamma}\right) \cdot Sn_1$$

The computation of Sn_2 by means of the above equations is applicable to the following film speed systems: Weston; H & D; Eastman on the proposed A.S.A. standards; any system in which the film speed number is inversely proportional to the exposure required to produce a given density for specified processing conditions.

In making the reading of the brightness of the reflected illumination with an exposure meter for the purpose of computing the exposure time for the test negative, it is suggested that a target be substituted for the subject which is to be photographed. This target should preferably be of the approximate color of the subject, and its surface should be diffuse. The size of the target should be such that the acceptance angle of the exposure meter will include nothing but the surface of the target, when held approximately 1 foot from the target. Desk pad blotters, 19 x 24 inches, come in assorted colors, and make suitable targets. When soiled, a new one is substituted. Such a target has a uniform diffuse surface which simplifies the measurement of negative density.

Appendix C. Derivation of Film Speed Equations (4) and (5).

In any film speed system in which the film speed number is inversely proportional to the exposure required to produce a given density for specified processing conditions, this proposition may be expressed by the following:

$$Sn = \frac{c}{En}$$

where: Sn = film speed number; c = a constant dependent upon the film speed system; En = negative exposure (in meter-candle-seconds) necessary to produce the given density.

Therefore: $Sn_1 = \frac{c}{En_1}$, and $Sn_2 = \frac{c}{En_2}$

where: Sn_1 = film speed used in making the test negative, or any film speed used for reference, which *may not give the desired density*.
Sn_2 = film speed which will give the desired density.
En_1 = exposure used in making the test, or reference negative.
En_2 = exposure which will produce the desired density.

Therefore: $\frac{Sn_2}{Sn_1} = \frac{En_1}{En_2}$

But: $E = I \cdot t$, where I = intensity of illumination on the negative emulsion and t = *exposure time*.

Therefore: $\frac{Sn_2}{Sn_1} = \frac{I_1 \cdot t_1}{I_2 \cdot t_2}$

type of apparatus used in making the measurements. The National Photocolor densitometer used to measure density in this laboratory is calibrated in steps of 0.02, and steps of 0.01 may be estimated without difficulty. Repeating the measurements a number of times and taking the arithmetical mean is usually a safe method of avoiding reading errors.

The author has computed that the *maximum probable error* could be as high as 17 per cent in the production of a desired density of 1.0 at a gamma of 0.96, under conditions existing in this laboratory. This would defeat the purpose of photographic processing control. It is unlikely that such an error would be produced in practice, as it would require an unusually unfortunate set of conditions. It does show, however, that great care must be taken in making all measurements and computations.

One of the frequent sources of error is in the use of an exposure meter to measure the brightness of the reflected illumination and to compute the exposure time. In biological photography, it often happens that the size of the subject is such that it does not occupy all of the acceptance angle of the meter. Fig. 7 shows a set-up—typical in this laboratory. Of the total area shown in the photograph, the plants occupy approximately 15 per cent, while 85 per cent is black background. The use of an exposure meter from the camera position is obviously impossible. Even if the reading is taken directly from the plants, the leaves are so small that

Fig. 7. Typical studio set-up. Plants occupy approximately 15 per cent, and the black background 85 per cent of the total area of the photograph.

such a reading would include an appreciable amount of background. Consequently, the reading would be too low, and the plants would be overexposed in the negative. When this is the case, a target***** can be substituted for the subject. Haskell[2], Cobb and Lowe[3] suggest types of targets. A green blotter, 18 inches square, is used as a target for most plant work in this laboratory. It is placed in the subject plane, and the measurement made, holding the exposure meter approximately 1 foot from the center of the target. The film speed, S_{n_2}, computed on this basis will, of course, be accurate for only the particular type of plant used when determining the film speed. It may be necessary to determine film speeds for a number of types of subjects. The same color blotter may be used, if the color approximates that of the subject. If the color of the subject differs from that of the target to any great degree, two things may happen: (1) the negative may be underexposed or overexposed, depending upon the spectral sensitivity of the emulsion; (2) the gamma may vary from that desired because of the possible variation of gamma with the wave-length of the incident radiation.

Where a linear relationship exists between two factors, and the equation of the straight line is computed by the method of least squares, the computed curve represents only the most probable position of the straight line on the graph, and some of the experimental points may not lie on the curve. In the interest of accuracy, as mentioned in Section II, E, Case 3, it is preferable to compute the values of b_1 and b_2 rather than to read them from the intercept-gamma curve. The chief value of this curve is in determining equation (3) from which the values of b_1 and b_2 can be computed. For the same reason, it would be better to compute the value of D_{s_1} from equation (2), rather than to read the value from the $D_n - D_s$ curve as shown in Section II, A, Case 1.

If the values of different factors are to be read from working curves such as are shown in Figs. 3, 4, 5, and 6, instead of being computed, the scales of abscissas and ordinates should be so chosen that the smallest subdivision corresponds with the accuracy of the data. In Fig. 3, for instance, each subdivision equals 0.10 density units. This corresponds with the calibration of the densitometer used to measure density. If a finer scale were chosen, the impression of greater accuracy would not be justified by the accuracy of the data. Plotting the graph to a coarser scale would sacrifice accuracy.

In making the photographs of the gray scales (Section II, A) the exposure time and intensity of the illumination should be approximately

***** See Appendix B.

[2] Haskell, Dudley: "Kodachrome Exposure." Camera Craft. Vol. XLV (March, 1938), No. 3, pp. 110-121.

[3] Cobb, R. M. K. and D. V. Lowe: "The Neutrowe Gray Exposure Aid." Photo Technique. Vol. 2 (September, 1940), No. 9, pp. 19-23.

that which would be used in practice for the type of subject for which the film speed is being determined. This procedure will compensate for any effect from the failure of the reciprocity law[4]. If this is not done, and there is any great change in intensity, requiring a much different exposure time, the desired density might not be obtained. The illumination in studio photography can usually be controlled, but in photomicrography the effect of the reciprocity-law failure may become serious unless precautions are taken to avoid it.

[4] Jones, L. A. and J. H. Webb: "Reciprocity Law Failure in Photographic Exposures." Journal of the Society of Motion Picture Engineers. Vol. XXIII (September, 1934), No. 3, pp. 142-159.

Appendix A. Method of Least Squares

Referring to Fig. 2, the equation of the straight line is: $D_n = -\gamma D_s + b$. The problem is to compute the value of γ and b. The following example and the formulae show how this is done. A table should be prepared as follows:

D_s	D_n	$(D_s D_n)$	$(D_s)^2$
0.60	1.29	0.77	0.36
0.90	1.01	0.91	0.81
1.10	0.81	0.89	1.21
1.30	0.60	0.78	1.69
1.50	0.43	0.65	2.25
1.62	0.32	0.52	2.62
1.72	0.24	0.41	2.95
8.74	4.70	4.93	11.89

Therefore:

$$\Sigma D_s = 8.74$$
$$\Sigma D_n = 4.70$$
$$\Sigma(D_s D_n) = 4.93$$
$$\Sigma(D_s)^2 = 11.89$$

Now:

$$\gamma = \frac{\Sigma D_s \Sigma D_n - N\Sigma(D_s D_n)}{N\Sigma(D_s)^2 - (\Sigma D_s)^2}$$

and:

$$b = \frac{\Sigma D_s \Sigma(D_s D_n) - \Sigma D_n \Sigma(D_s)^2}{(\Sigma D_s)^2 - N\Sigma(D_s)^2}$$

where N = the number of observations. (Note that the first three points, where D_s equals 0.0, 0.16, and 0.40, were omitted from the calculations. This was done because it was felt that they might not fall on the most probable straight line. Fig. 2 shows, however, that they are not far from the straight line.)

Therefore:

$$\gamma = \frac{8.74 \cdot 4.70 - 7 \cdot 4.93}{7 \cdot 11.89 - 8.74 \cdot 8.74}$$

$$\gamma = \frac{6.57}{6.84} = 0.96$$

and:

$$b = \frac{8.74 \cdot 4.93 - 4.70 \cdot 11.89}{8.74 \cdot 8.74 - 7 \cdot 11.89}$$

$$b = \frac{-12.79}{-6.84} = 1.87$$

These values are substituted in the equation giving: $D_n = -0.96 D_s + 1.87$.

From this equation, the value of the D_s intercept is calculated—when $D_n = 0.0$, $D_s = 1.95$. As b equals the value of D_n when $D_s = 0.0$, the two intercepts give the position of the straight line without laying out the slope (γ). This not only saves time, but gives greater accuracy.

Appendix B. Film Speed Equation for Constant Gamma

If the value of the negative gamma is known, and if it is a satisfactory value with respect to the exposure scale of the positive material, the problem of computing the film speed necessary to obtain the desired negative density is simplified. All the information may be obtained from a single test negative developed to the known gamma. A transmission densitometer must be used to measure the negative densities.

Let: Sn_1 = film speed used in making the test negative; usually the published film speed.
Sn_2 = film speed which will give the desired density.
Dn_1 = density of the test negative.
Dn_2 = desired density.
γ = negative gamma.

Then: where $Dn_2 > Dn_1$,

$$Sn_2 = \frac{Sn_1}{\text{antilog}_{10}\left(\frac{Dn_2 - Dn_1}{\gamma}\right)}$$

Or: where $Dn_1 > Dn_2$,

$$Sn_2 = \text{antilog}_{10}\left(\frac{Dn_1 - Dn_2}{\gamma}\right) \cdot Sn_1$$

The computation of Sn_2 by means of the above equations is applicable to the following film speed systems: Weston; H & D; Eastman on the proposed A.S.A. standards; any system in which the film speed number is inversely proportional to the exposure required to produce a given density for specified processing conditions.

In making the reading of the brightness of the reflected illumination with an exposure meter for the purpose of computing the exposure time for the test negative, it is suggested that a target be substituted for the subject which is to be photographed. This target should preferably be of the approximate color of the subject, and its surface should be diffuse. The size of the target should be such that the acceptance angle of the exposure meter will include nothing but the surface of the target, when held approximately 1 foot from the target. Desk pad blotters, 19 x 24 inches, come in assorted colors, and make suitable targets. When soiled, a new one is substituted. Such a target has a uniform diffuse surface which simplifies the measurement of negative density.

Appendix C. Derivation of Film Speed Equations (4) and (5).

In any film speed system in which the film speed number is inversely proportional to the exposure required to produce a given density for specified processing conditions, this proposition may be expressed by the following:

$$Sn = \frac{c}{En}$$

where: Sn = film speed number; c = a constant dependent upon the film speed system; En = negative exposure (in meter-candle-seconds) necessary to produce the given density.

Therefore: $Sn_1 = \frac{c}{En_1}$, and $Sn_2 = \frac{c}{En_2}$

where: Sn_1 = film speed used in making the test negative, or any film speed used for reference, which *may not give the desired density*.
Sn_2 = film speed which will give the desired density.
En_1 = exposure used in making the test, or reference negative.
En_2 = exposure which will produce the desired density.

Therefore: $\frac{Sn_2}{Sn_1} = \frac{En_1}{En_2}$

But: $E = I \cdot t$, where I = intensity of illumination on the negative emulsion and t = *exposure time*.

Therefore: $\frac{Sn_2}{Sn_1} = \frac{I_1 \cdot t_1}{I_2 \cdot t_2}$

But it has been assumed that the photographs will be made on an intensity-scale basis in which the exposure time (t) is constant. Therefore $t_1 = t_2$, and therefore,

$$\frac{Sn_2}{Sn_1} = \frac{I_1}{I_2} \qquad (a)$$

Now: $D_S = \log_{10} \frac{Fo}{Fr}$, where: D_S = gray scale density; Fo = luminous flux incident upon the gray scale; Fr = luminous flux diffusely reflected by the gray scale.

In photographing gray scales by the method described in Section II, A, the intensity of the illumination on the gray scales is constant, and therefore Fo is a constant. The intensity of the illumination which reaches the emulsion (I) is directly proportional to that which is reflected by the gray scales (Fr). Under constant conditions of camera set-up when photographing the gray scales, this relationship may be expressed as follows: Fr = aI, where a is a constant dependent upon the camera set-up.

Therefore: $D_S = \log_{10} \frac{k}{aI}$, where k is a constant equal to Fo.

and: $D_{S_1} = \log_{10} k - \log_{10} aI_1$
$D_{S_2} = \log_{10} k - \log_{10} aI_2$

Transposing: $\log_{10} aI_1 = \log_{10} k - D_{S_1}$ (b)
$\log_{10} aI_2 = \log_{10} k - D_{S_2}$ (c)

But: $\frac{\log_{10} I_1}{\log_{10} I_2} = \log_{10} I_1 - \log_{10} I_2$ (d)

Combining equations (b) and (c) with (d) in which process the constant a in equations (b) and (c) cancels out—

$$\frac{\log_{10} I_1}{\log_{10} I_2} = \log_{10} k - D_{S_1} - \log_{10} k + D_{S_2}$$

Therefore: $$\frac{\log_{10} I_1}{\log_{10} I_2} = D_{S_2} - D_{S_1}$$

Therefore: $$\frac{I_1}{I_2} = \text{antilog}_{10}(D_{S_2} - D_{S_1}) \qquad (e)$$

Combining equation (e) with (a), and transposing,

$$Sn_2 = \text{antilog}_{10}(D_{S_2} - D_{S_1}) \cdot Sn_1 \qquad (4) \text{ in text.}$$

Equation (5) in text is merely another form of equation (4), transposed to avoid the use of negative logarithms when $D_{S_1} > D_{S_2}$.

BOOK REVIEW

THE THEORY OF THE PHOTOGRAPHIC PROCESS, by C. E. Kenneth Mees, D.Sc., F.R.S. Published by The Macmillan Company, New York. 1085 pages, 6 x 9¼, 406 illustrations, cloth bound, $12.00.

Dr. C. E. Kenneth Mees, who is Vice-President of Eastman Kodak Company and Chief of its Research Laboratories, needs no introduction to those interested in photography. His contributions have always been outstanding, and surely this new book will be of great value to the student of photography as well as to the scientist who will find in it an exhaustive discussion of the science of photography. It is divided into six sections: The Photographic Material, The Action of Light, Development and the After Process, Sensitometry, Photographic Physics and Optical Sensitizing. There are twenty-five chapters well illustrated. Many of these chapters contain subject matter about which little has been written. An extensive bibliography accompanies each chapter. An author and subject index is included.

Visual Aids in Education for Venereal Diseases[1]

by Herman Goodman, B. S., M. D.*

VISUAL aids in education fall into the normal, average, everyday categories of visual aids in any other field. They may be prepared or planned by every health education specialist. For venereal diseases certain pitfalls must be avoided. The universally accepted criteria of a visual aid are: to arrest attention; to impel to read; to compel to act. Any form of arrest of attention may be employed for health education in many diseases. Venereal diseases require certain restrictions. The popular fallacies—venereal diseases and plague—syphilis and leprosy—are to be avoided. Some years back, in a public poster contest in venereal disease education, the most prevalent symbols submitted were the skeleton (death was not on a holiday) and the spear or needle of the injection treatment. Neither motif was acceptable then. They are not utilized now! The red color of blood means trouble to the average person. Venereal diseases are dangerous. Red means stop. This association is harmful in visual education for venereal disease, as harmful as somber funereal black. Both these colors are avoided. The bright colors — leading to hope — orange — sunburst — midsummer blue sky coloration meet the need for arrest—for stop—in the poster or exhibit otherwise static.

Venereal disease education through visual aids avoids the opposite pitfalls. There is not too obvious Pollyanna stuff. First because venereal diseases are not a picnic despite the advances made through the dye products as salvarsan or arsphenamin and the miracle dyes of the sulfonamide group. Second; there remains a group of citizens, influential in high places, critical of minimizing the dangers of venereal diseases. The artist, the photographer, the technician in venereal disease health education through visual aids steers his course carefully in consequence.

The other danger is to paint too dastardly a picture—to portray ulcers, scars, the blind, the halt and the lame. Let experience guide. The pos-

[1] (Read by invitation before the Twelfth Annual Convention of the Biological Photographic Association, Park Central Hotel, New York City, September 11, 1942.)

* New York City. Received for publication November, 1942.

sible consequence of exposure to venereal disease does not deter exposure of physicians, nurses, medical students! Nor does it deter exposure of practitioners of the art and science of biologic illustration!

What can be illustrated in venereal disease? How can it be illustrated? What modes of visual education are available?

Practical point: for whom is your visual aid intended? Is it for physician, for patient, for public? Each requires a different illustration. The public is not always the subject of the disease. The physician is sometimes taught by the appeal to the patient. Our visual aid follows the path set. For the physician there is professional education; for the patient, a message of hope for ultimate cure through confidence in his physician; for the public emphasis on the characteristics of the venereal diseases assuring freedom from infection.

What can be illustrated? For the physician the entire gamut of symptoms and procedures of detection and treatment of the various members of the group of venereal disease is available. Microscopic specimens mean something to the physician accustomed to examine slides. The spirochete pallida, the gonococcus, etc. are known to the professional person. Lumbar puncture or cisternal puncture do not cause the physician audience to gasp, or faint, or close the eyes.

The same scenes visualized for the lay audience bring trouble in their path. A clinical picture shown to patient adds to resistance to the same procedure required for diagnosis. The non-infected citizen has no interest in a cross section of the spinal cord in tabes.

What can be illustrated to arrest the attention? Give positive suggestions. Recall the cardinal features of venereal disease control. For the physician: "Find the Case" offers illustrations of the home, the factory, the selective service board, the expectant mother. The feature of "Treat the Case" gives illustrations of the doctor's sign, the health center, the hospital entrance. The feature of "Find and control those from whom the disease was acquired and those to whom it may have been given" presents illustrations of visiting nurse; conference nurse. The feature of "Education" presents illustrations of audience of workers; of soldiers; of medical students; of public health nurses.

Cardinal features for the patient are: (1) detection of the disease; illustration of X-Ray machine; stethoscope; microscope; laboratory scenes; (2) treatment: schedules; calendars; ampuls; (3) determination of cure: knee jerks; ophthalmoscope; benign physician posing with patients on last visit; the man and woman with a "little child shall lead them" motif.

For the public not infected, other headlines and illustrative material suit: (1) the venereal diseases are catching diseases; illustration of intriguing epidemic charts with figures in black and white; (2) the venereal diseases are prevalent: illustrated by charts and graphs; (3) the venereal diseases are avoidable: illustrations of positive social aids as games, dances, church socials; U.S.O.; Y.M.C.A. physical exercises, etc.; (4) venereal diseases are preventable: (a) illustration of chemical means: antiseptics; solutions; salves; soapsuds; (b) Army and Navy first aid stations or prophylactic stations.

The modes of visual education available for venereal disease control are named. Every means at the command of the health education expert is utilized—the throw away; the pamphlet; the booklet; the poster; the exhibit in three dimensions; the still photograph; the cartoon; the poster; the car card; the full page spread; the lantern slide; the strip film; and the movies. All of them are utilized in one or another combination, as issuance of a broadside to each member of the audience at the projection of a moving picture.

In illustrative material, one takes into account the social side of everyday life. There are colored physicians as well as colored patients, for example. Do not stigmatize one race against another by limiting the illustration of patients to one. Recognize the professional status of colored physicians by including them in illustrations of health center or other medical and professional activities. It is fascinating to consider the lack of visual aids in general health education designed for minority racial groups. The error is not made in venereal disease control.

The terminology of venereal disease control reflects certain attitudes impossible to ignore in visual aid planning. In some states, the bureau or department responsible for this section of health is called syphilis control rather than venereal disease control. Other states give the name 'Social Hygiene'. Among some people, social hygiene means sex hygiene, to others it means feminine hygiene; to still others it connotes birth control. One large city school system cancelled its scheduled showing of films because the title of one of them was "Sex Hygiene for Women"!

Despite two wars in recent times, despite enlightenment, votes for women and all, we are still in the dark ages when we compare the advances made in social hygiene to those in other health fields, as in tuberculosis.

The pictorial portion—the arresting of attention quotient of the poster, throw away, and so on—never replaces or supplants the text.

The person stopped by poster is not satisfied with the poster. He wants more than the poster. He is not given the opportunity to become over-enthusiastic regarding the cleverness or trickiness of design or color combination or unique quality of the illustration as to forget to appreciate the text. There is a ceiling to utility or bizarre art forms. The good poster leads to something else—the job for which the poster was created. In venereal disease control, the text is short, monosyllabic if possible. As many posters are available as the number of large language groups in the community. Great care is exercised to utilize the actual idiom of the language group. Spanish of Castille is not the speech of Central Americans nor of the people of the islands of the Carribean Sea.

The content of the word appeal is on the same general plane as the illustrative material. It follows the same division—for the physician—for the patient—for the non-infected public. The words are directed at the reader—YOU instead of OUR is a good plan. Appeal to the selfish interest of the reader! If you find a near universal selfish appeal, your fortune is assured. Many texts are monotonous. Right now they are based on war and warriors. Some become ridiculous in consequence.

We avoid these errors in venereal disease. We stress simple often self evident truths. "See your Doctor, have a blood test", nothing new but effective. "No physical examination without a blood test" tells its story. "Make your birthday your health day—be examined" is not too difficult to understand. These texts have been utilized time and time again. The simple "Be Fit" helps. Or a statement "Gonorrhea is curable".

The artist, the technician, the slogan maker oftentimes becomes so enthusiastic over the illustration, the mechanics of the exhibit, or the angles of the camera as to completely forget or ignore the PURPOSE—the *original* purpose of the visual aid. Nothing in the illustration, nothing in the exhibit, nothing in the movie tells the reader whose attention has been arrested, who has read the text, WHAT to do. Nothing compels him to ACT. Nothing facilitates his action! There is no address, no telephone number, no hours, no notice of freedom of cost or of price. The entire matter DIES.

The planned compulsion to act is organized. Merely the word NOW no matter how large, or how loud, does not compel. There is a name and an address. There are directions, hours, telephone numbers. The compulsion to act is simple and short. Not every person stopped, not every person taking time to read has pencil and paper to copy a long address. The successful compulsion to ACT is short, easy to remember,

or easy to reconstruct later. "See your local telephone book" helps. "Pick up the phone and ask for Health Department Headquarters" is better. Provide arrangements to properly plug the lines of the health department!

The directions for completion of compulsion to act are as simple as the remainder of the message, perhaps simpler.

Visual aids in venereal disease control are prepared mainly for or for sale to governmental agencies or voluntary agencies assisting official ones. The question of cost is very important. Not the original cost, perhaps, but the overall cost as measured by length of service, general availability, timeliness over a period of years; dating of the topic, of the presentation, of the facts, of the mode of approach.

A film costing five hundred dollars may be much more expensive than one costing twelve thousand. The five hundred dollar film may be suitable for projection only to selected groups of super-specialists meeting once a year, let us say. For the sake of argument, we measure five hundred in the audience (one dollar cost per person). The twelve thousand dollar film has mass appeal; it is viewed by six thousand persons per month over a period of two years (a few cents per person.) The original negative of a strip film may cost no more than one hundred dollars. Its positive prints have a life of several years. It may be shown to several thousand persons a month for three years. Its original cost is trifling. If outdated, it may safely be discarded with hope of some salvage, or, it may be amended at small additional cost.

The film cost is not the only factor. There is the problem of projection apparatus, operation, upkeep. A sound projecting machine is costly. It needs vehicular transportation. It requires an expert operator. Some communities insist on licenses for both machine and men. A strip film projector is simple, low in cost and negligible in upkeep.

A movie, silent or sound, is immutable. Its projection does not permit of personal comment by a lecturer. He cannot compete with the sound track. He dare not impugn the silent titles. The strip film is free of these objections. Each lecturer colors the illustration with his own experience.

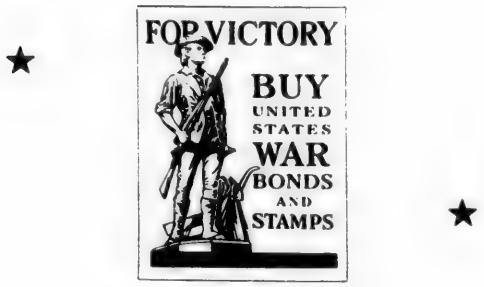
A few additional practical points: Good illustrations of clinical cases are free of identifiable facial features. Further, the hair dress, style of beard, clothing are undated. There is no distraction from the clinical picture. Attention is not divertible to a bizarre extraneous shirt collar, for example. It is best to have all photographed parts free of clothing;

with hair covered by a cap; with eyes or other portion of the face blacked out.

Stocks of visual aids should not be large merely because the second thousand or the second hundred thousand is so much cheaper than the first. Unless employed to advantage, the second thousand or the second hundred thousand is a costly dead loss. In venereal disease control, changes are sudden and dramatic. A poster or other visual aid prepared last year before the glories of the miracle drugs of the sulfonamid group were recognized is fit only for the paper salvage truck. The same holds for other educational material. Small orders completely exhausted and repeated as needed are more helpful than large store rooms crowded with outdated junk material.

Variety of the visual aids in venereal disease education is also helpful. Variety prevents anesthesia to an appeal to act by the exhibit.

The cost of the individual exhibit of visual aid material is kept as low as possible to permit the preparation of numerous examples; each different. For the same reason, the exhibit is of temporary nature—not built to be permanent. The exhibit is classed with the throw away—expendable material not subject to accounting. This is possible only with the lowest cost in the conventional governmental auditing systems.



A Useful Screen Grid for Clinical Photography

by F. R. Harding*

IN the past there have been several types of cross-lined screens or screen grids employed in an attempt to show asymmetry, or deviation from the normal in posture. The screens have taken several forms. One type consists of a large wooden frame upon which white cotton strings are stretched tightly both horizontally and vertically. This produces a screen divided into squares. This type has several disadvantages: The string soils quickly, and alternately stretches and shrinks with varying degrees of humidity. When it is placed in front of a patient, shadows are cast on the subject by the strings. Small children are alarmed when it is placed in front of them. It is also a bulky piece of apparatus to store when it is not in use.

Another type is a cross-lined screen painted on the wall. If there is sufficient space to maintain more than one background, the painted screen will serve its purpose if it is not desirable to have the lines appear on the patient. This type of screen is frequently used when the object is to measure only height and breadth. The string and painted screens have one common disadvantage, that the screen is a part of the negative. This means that if a photograph is desired without the crossed lines, another negative must be made. This is usually not possible.

Several years ago the writer developed a cross-lined screen which eliminates many of the disadvantages of the older types of screen. It consists of a sheet of acetate celluloid of the same thickness as cut film, or sheet film as it is sometimes called. Draw on a sheet of paper ruled lines ¼ inch apart, both vertically and horizontally so that the sheet is broken up into ¼ inch squares. Use a sheet of celluloid as large as the largest negative employed. Place the ruled sheet under the celluloid and fasten them together securely. Using the ruled lines as a guide, lines are now cut into the surface of the celluloid sheet. These lines must be CUT into the surface with a sharp knife in order to get a clean line. If an attempt is made to scratch the lines in, a ragged line will result.

* From Children's Hospital, Boston, Mass.
Received for publication February 12, 1943.

Care must be taken that the lines are not cut too deeply into the sheet or it will split when slightly flexed. A red or black grease pencil is rubbed all over the finished screen and then the screen is polished with a soft cloth. This drives the pigment into the cut lines. A true vertical line must be painted on the background. The line should be established by a plumb line and the painted line should be narrow in width. Whenever a patient is photographed and the screen is to be employed, the vertical line should be included in the negative, preferably near the film edge.

To use the screen it is placed on the printer and the negative is placed on top of the screen. The vertical line on the background is lined up with one of the vertical lines on the screen, a sheet of printing paper is placed on the negative and the print is exposed in the usual manner. The use of the screen will increase the exposure very slightly. Any deviation from normal symmetry in the subject is clearly shown.

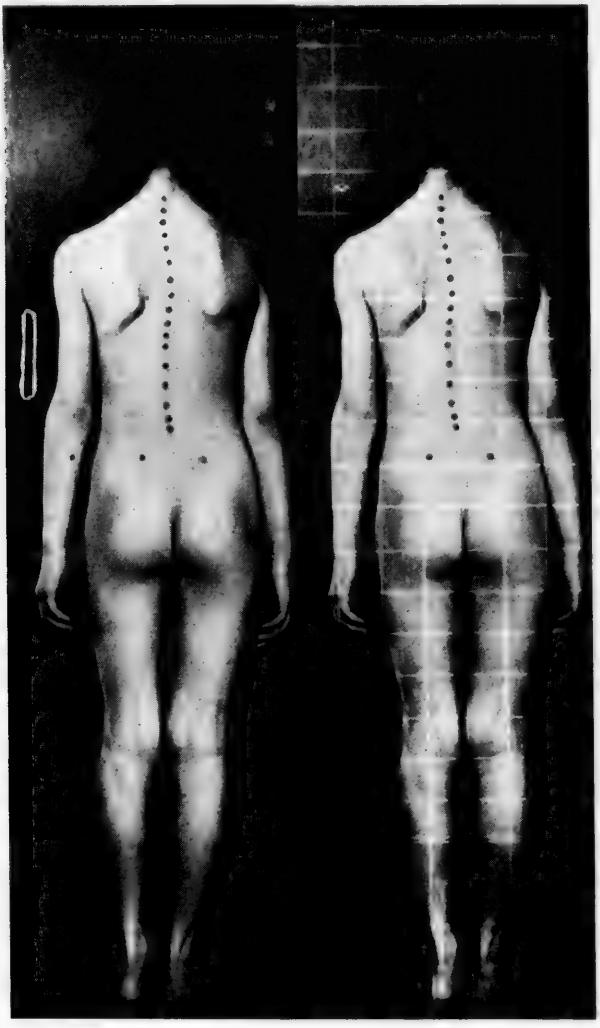
For some purposes the background line may be eliminated. To show asymmetry of the face, for example, one line of the screen may be placed through the pupils of the eyes, if the eye line is normal.

The screen is very useful in the posture clinic. For this purpose the spinal course should be outlined by dots, employing a skin pencil. The posterior superior spines should also be marked. The writer has found that a black or dark brown eyebrow CRAYON is superior to most regular skin pencils, as it will leave definite mark on moist or greasy skin without using undue pressure. Be certain to use the soft crayon type which is sold in small metal tubes. The pencil type is no better than a regular skin pencil. When employing the screen for posture, one line of the screen should pass through the crease of the buttocks. This will show any deviation from the normal in the spine. The screen can also be employed to show head tilt in torticollis, the Trendelenberg sign in dislocated hips, bow legs, knock knees, etc.

The screen has many uses in clinical photography, and many advantages over the older types of screens. The patient never sees it, there are no shadows of lines to confuse the issue, and prints can be made with or without the screen at any time. Old negatives may be used with the screen unless posture or full length figures are involved, in which case the vertical negative line is needed. The screen once made will last for several years before needing renewal.

The illustration shows two prints from the same negative. One is a straight print and on the other the screen grid has been used. The

screen shows clearly that the patient's body tilts to the left above the pelvis. Note how apparent this is in the photograph where the screen was employed, and how difficult it is to see the tilt in the unscreened print.



Association News

NEWS OF OUR MEMBERS

Lt. C. Graham Eddy's resignation as a Director of the B.P.A. has been accepted with regret by the Board. Lt. Eddy wrote that as he was leaving the country for foreign duty he felt his place should be taken by some one who could be more active in Association affairs. His successor will be appointed by the President and the remaining members of the Board, and will be announced in the Journal.

Like many scientific photographers, Lt. Eddy started out by way of commercial photography. After two years in portrait studios he joined the Section of Photography of the Mayo Clinic and spent six years there. He left the Mayo to take charge of the photographic department of the Eloise Hospital, Michigan. This is a large county hospital, with a wide range of subjects for a clinical photographer. Many of our members will remember seeing examples of his clinical, gross and photomicrographic work in our Salons and Albums. Lately his name has become associated with endoscopic photography. He collaborated with Dr. Thomas N. Horan on an article on "Intra-Abdominal Photography in Color" which appeared in the Journal of Surgery, Gynecology and Obstetrics, Sept. 1941, Vol. 73. The technique described in this article was portrayed in an exhibit which won Honorable Mention at the Atlantic City Meeting of the A.M.A., 1942, and a Kodachrome motion picture on Laparoscopy made by Lt. Eddy was among the films shown during the motion picture sessions of this meeting. In the fall of 1942 he enlisted in the Medical Arts Service which had been activated at the Army Medical Museum the previous spring. He was made officer in charge of the first unit and, after a period of preparation, his unit was ordered on active duty.

We hope some day the B.P.A. will have the full story of Lt. Eddy's experience in recording the medical procedures of this war. He has been one of our members since 1935, a Director since 1940. He has good friends in the Association and I am sure letters giving the news on this side will be very welcome to him. His address is:

Lt. C. Graham Eddy, SNC, 20th General Hospital, APO 3492, c/c Postmaster, New York, N. Y.

Lt. Eddy's pro tem successor as head of the photographic department in the Eloise Hospital, Michigan, is another B.P.A. member, Mr.

Albert Sadler, formerly photographer at St. Vincent's Hospital, New York, N. Y.

Mallinckrodt's Photo-Bulletin No. 48 features three striking photomicrographs, complete with technical data. One is of a section of spine from the Echinus, or Sea Urchin, of Panama. ("A Colonial Crocheted Rug", as Mallinckrodt describes it). Another is a section through the epithelium of skin. The third is of cobalt nitrate crystals, made with polarized light. They are highly decorative pictures. All three were made by Leo Massopust, B.P.A., Director of Art and Photography, Marquette University School of Medicine.

The Salem Deaconess Hospital, Oregon, opened a Clinical Photographic Laboratory Department on December 14, 1942. The new Department held open-house, at which one of the features was the 1942 B.P.A. Traveling Salon. One of our members, Glen C. Wade, will be in charge of the department, which is equipped to furnish a wide range of clinical pictures.

Immediately inside the cover of TIME for January 25, 1943 is a full-page ad for the Goodrich Company. It shows an incubator standing on a sturdy table. The incubator contains a microscope, and a motion picture camera is swung from the ceiling in such a way that it can be used with the microscope without actually being in contact with it. It is an impressive set-up, with an air of having been custom-built for a special purpose. And so it was. Old-timers at our Convention will remember having seen this same picture among the illustrations of Dr. Proetz's set-up for lapse-time photography of ciliated epithelium. And it appeared in our Journal, Vol. VI, No. 2, December, 1937, in a brief but informative article by Dr. Proetz about his lapse-time technique.

Goodrich has this to say beneath this familiar picture: "RUBBER SOAKS UP THE JIGGLES—NOW DOCTORS READ THE TRUTH. Medical men save lives by knowing how human tissues grow, change, develop. But doctors can't live with eyes glued to microscopes. Photographing growing tissues automatically, in successive stages, through powerful magnifying lenses, would save time, and also provide a better and permanent record.

But the slightest vibration in the object being photographed ruins results, makes the prints look like graphs of jiggles instead of photographs of human tissues. A St. Louis scientist had an idea—design a table whose legs would be made of alternate layers of concrete for solidity and sponge rubber to absorb vibration.

But the rubber would have to be strong enough to support the heavy concrete without flattening out, soft enough to absorb the vibration passed through the ground, yet not soft enough to set up any swaying action."

1943 CONVENTION

This is the issue in which we would like to tell you Convention plans. But in these times, it is too early to be definite. Mr. Eastman, Coordinator of Defense Transportation, has requested that "Conventions should not be held unless related to the war effort." It is the phrase "related to the war effort" that we must continue to weigh against existing circumstances as the months go by. Some societies, whose large membership means a far greater strain on transportation facilities than ours, are continuing to schedule their meetings. Evidently they believe that the opportunity to meet and formulate plans will in the end outweigh the burden they place on train and hotel accommodations. On the other hand, other societies whose work seems closely bound with the war or the educational program, have cancelled their meetings. So far, at least, it seems a matter of individual interpretation.

Our Convention group is a small one, and we could choose a locality where housing accommodations are not needed for military or war-plant purposes. Therefore we need not impose a great burden on urgently needed facilities. Whether conditions as time goes on will make every burden however slight unwarranted, remains to be seen. In these days of accelerated teaching, photographic programs and techniques are important and it may be more patriotic to meet and plan these matters than to stay at home and go our separate ways. On the other hand, many of us are so busy trying to meet the new teaching programs that we could not get away no matter how much we believed in it. All these factors must be considered.

If we do hold a Convention, it will be on shorter notice than usual and we will have to do everything possible to simplify arrangements for the local Committee. There will undoubtedly be more round-table sessions, and more time alloted for special meetings to integrate our efforts in various fields of work. Only the knowledge that we have important questions to discuss could justify a meeting, therefore, we would try to make the discussions as far-reaching as possible.

ALIEN PATENTS AVAILABLE

50,000 patents once owned by residents of enemy or enemy-occupied countries are now available to American science and industry. The government through its Alien Property Custodian is requesting every businessman to study the index of these patent classifications. Full information concerning them is being circulated among research centers; universities, technical, professional and learned societies; trade journals and newspapers. As a society in the above category, we have been asked by Mr. Leo Crowley, Alien Property Custodian, to inform our members how they may obtain full information about these patents and their licenses. Any reputable American firm or individual is eligible to receive licenses under vested enemy patents and patent applications, in accordance with certain terms and conditions.

The tens of thousands of patents are divided into some 300 classifications. An index of classifications and a pamphlet containing the terms and conditions of licensing can be obtained either by writing your Secretary or writing Mr. Leo Crowley, Alien Property Custodian, Washington, D. C. Lists including all the patents and patent applications within any individual classification may be had for 10c, except in the case of nine leading categories, for which the charge is 25c, owing to the very large number of patents listed. These nine largest classifications are: Chemistry, Chemistry (Carbon Compounds), Internal-combustion Engines, Machine elements and mechanisms, Optics, Photograhy, Radiant Energy, Telegraphy, Telephony.

A complete catalogue, without binders, can be obtained for $5.00. Printed copies of vested patents and drawings and specifications of vested patent applications may be secured from the Commissioner of Patents, Washington, D. C. for 10c each. Licenses are granted for the life of the patents. No exclusive licenses will be issued.

The index listing the 300 classes of patents and patent applications is enclosed in a pamphlet entitled "PATENTS AT WORK, A Statement of Policy by the Alien Property Custodian of the United States". The following quotations are taken from this statement:

"They (the patents) cover inventions in every field of applied science and represent millions of man-hours of research and the expenditure of many millions of dollars . . . For our part we pledge, first, that the patents directly controlled by this agency of the government will be available readily and immediately to serve all American industry, and that active use of the store of technical knowledge which these

patents represent will be fostered; second, we pledge that we shall encourage further research on these inventions for the lasting benefit of American industry, American labor, and the consuming public; and third, we shall take all steps within our power to make certain that vested enemy patents are made available forever to American industry . . . We shall make careful investigations to discover the major possibilities of the important inventions and we shall offer expert technical assistance to American business to help in bringing these patents into effective use . . . The patent policy of the Alien Property Custodian has been designed to further two major objectives—the winning of the war and the permanent enlargement of our national production in the post-war period . . . By this licensing policy, this government offers to the American people the vast fund of research represented by the patents vested under the President's War Powers. They were made available without the restrictions and substantial royalty costs which ordinarily accompany new inventions".

VISIT TO THE ARMY MEDICAL MUSEUM

The word Museum means, to most people, a quiet place chiefly inhabited by guards and glass cases. One of the best ways to exchange this old-fashioned concept for an up-to-date appreciation of a Museum's active services to a community or an entire country, is to take a trip through the Army Medical Museum in Washington. True, there are plenty of glass cases in this big old red-brick building. There are rows of specimens, and moulages and pictures showing war-wounds and diseases. There is a hall lined with historical microscopes; and a room containing drawer on drawer of lantern slides available on loan for teaching purposes. A portion of the building is occupied by the world famous Army Medical Library, popularly known as the Surgeon General's Library.

But in and among these museum-like aspects the key-note is activity. Medical artists are busy in one department working in oils, water-colors and other media. Some of their pictures are for the Museum's permanent collection, but the great majority are for dissemination to the Services. Nearby is a laboratory where moulages are made for the same purposes. Besides the standard types, thin sheaf-like moulages are made of Latex or some similar material. These can be placed over various parts of a model's body for demonstrations and can be worn by men on maneuvers to illustrate in realistic fashion the need for various types of treatment.

On the second floor the Curator, Colonel J. E. Ash has his office, and around him are the central pathologic laboratories of the U. S. Army, busy with thousands of microscopic sections covering the field of war-pathology and general pathology. These laboratories are the consultation as well as Chief Diagnosis Center for pathology in the Army.

As to photographic activities, they pervade the Museum from top to bottom. The Medical Arts Service, called into being by World War II, has its offices on the first floor. Here Captain Creer interviews artists and photographers for assignment to the various units to be sent on foreign duty. These men, experienced craftsmen for the most part, go through a training period working with the type of subject they will meet overseas and using the equipment which will be standard throughout the units. An interesting exhibit in one of the offices showed photographs taken by some of the unit-photographers depicting the type of wounds received in battle. Mounted beside them were photographs made by Life Magazine photographers for a story on a similar subject. Both were good sets of prints but the contrasting motive behind each was interesting. Life's were human-interest pictures. They showed the men and their hospital surroundings, but as sources of scientific information they were not helpful. The Museum photographers, on the other hand, concentrated not on the man with the wound but on the wound itself. They were clear, excellently conceived and executed examples of medical illustration.

The Museum's general photographic department, situated on the top floor, is under the direction of Mr. Roy Reeve. Here routine photography for record and teaching purposes co-exists with advanced research on color methods, etc. Mounting and assembling are done in a bright central room from which various specialized work-rooms and dark-rooms branch out. In the copying-room, for instance, a typical assignment was finished recently: over 9000 copies of X-rays were made to be distributed for reference to various induction centers. This piece of work is only one example of the Museum's usefulness as a reference center. Even in peace-time its artists, photographers and technicians are kept on the go. In war-time the scope of work is immediately stepped up, not only by the immediate need for a more continuous flow of teaching aids, but also by the greater range of subjects to be covered. The Museum, for instance, will soon be receiving material from its units abroad, which must be integrated and prepared for distribution as soon as possible.

Your roving Secretary made a brief tour of this institution in January, conducted by Captain Creer who was most hospitable and

generous with his already well-filled time. It was a Saturday afternoon, an interim when a week-end lull might have been expected. Perhaps on week-days activities are at an even higher pitch, but I can vouch for the fact that even on week-ends a brisk amount goes on. There was only time for a glance at the many collections that would repay days of study.

When we took time out for lunch Fate most kindly prompted Lloyd Varden to walk into the same restaurant. Mr. Varden, as we reported before, is Chief of the Photographic Film and Papers Unit in the Motion Picture and Photography Section of the War Production Board. He had a meeting with a group of Hollywood manufacturers to prepare for, and so could not linger long.

I also had a telephone conversation with Maj. Art Fuchs, now attached to the office of the Surgeon General. He asked about the B.P.A. and said he believed that scientific photography was due for great expansion after the war. No one could doubt that, after seeing the thorough preparations being made at the Army Medical Museum for adequate photographic records, present and future.

REPORT OF THE COMMITTEE ON MOTION PICTURES

I. *Surveys.* The Committee on the use of Motion Pictures of the Society of American Bacteriologists is conducting by questionnaire a survey of available films and their use in *bacteriology.* Our members are urged to send any information they may have in this field to Dr. H. E. Morton, School of Medicine, University of Pennsylvania, Philadelphia, Pa.

Through the kindness of Dr. T. G. Hull and the Committee of Scientific exhibits, an open meeting was arranged by Dr. A. Nichtenhauser (Am. Film Center) for those interested in films at the American Medical Association meeting at Atlantic City, June 10, 1942. The meeting was organized by Dr. Benedict (Mayo Clinic), Chairman, Dr. Coffey (U. S. Pub. Health Service), Dr. Ferris (Wistar Institute), Mr. Harding (Northwestern Univ.), Dr. Richards and Ensign Sturgis (Nat'l. Naval. Med. Center). About 80 attended the open meeting.

That evening those especially interested met at the Hotel Traymore and organized the American Committee on Biological and Medical Films. Dr. Ferris was elected chairman and Dr. Nichtenhauser secretary. The object was to formulate a program, endeavor to obtain funds for it and to carry on until a permanent group could be organized. The

greatest need appeared to be for a catalog of films, preferably with critical reviews and a brief description of each of the films. Funds are forthcoming from the American Film Center, and the Atlantic City Committee are working toward a permanent organization which will have representation from all groups concerned with motion pictures in these fields. The postponement of scientific meetings during the emergency has delayed the project. Our committee will co-operate closely with them and we hope that the survey of scientific films may start soon.

II. *Films reported by our members in* 1942.

H. B. Armstrong: Dacrocystorhinostomy for chronic dacrocystitis; Operative treatment of post-traumatic knee; Arthrodesis of wrist using illium bone grafts. 16 mm.

C. G. Eddy: Intra-abdominal examination to include biopsy, direct cholecystography and photography in color; Examination for cancer at sites of greatest frequency, two reels, 300 ft. 16 mm.; Occupational and recreational therapy, 700 ft. 16 mm.; The hypoglycemic treatment of chronic schizophrenia, 650 ft. 16 mm.

E. J. Ferris: Tropical opossums, 400 ft. Kodachrome.

F. W. Kent: Technique of transurethral surgery, 5 pts. 16 mm. Kodachrome.

M. W. LaRue: Treatment of oral pathology, 4 reels; Collapse therapy in pulmonary tuberculosis, 3 reels, color; Fractures of the os calcis, 2 reels, color; Varicose veins and their complications, 3 reels, color; Management of gall bladder disease, 4 reels, color; Surgery of the common bile duct, 2 reels, color; Vitamine therapy, thiamine chloride, 2 reels, color; Same, riboflavin. 3 reels, color; Same, nicotinic acid, 3 reels, color; Syringes and needles, 6 reels, color; Prevention and immediate care of athletic injuries. All accepted by the American College of Surgeons.

J. A. Maurer: Surgical treatment of varicose veins by high saphenous ligation, 16 mm. Kodachrome; Operations for common head injuries, 2 reels; Bowel resection by lateral anastomosis; Glaucoma, 16 mm. Kodachrome.

W. H. Oliver, Jr.: Beachcombing for marine life, 2500 ft. Kodachrome.

S. E. Riesner: Animation of a serial study of x-rays of the jaw joint in the opening and closing process, 200 ft., 16 mm.

H. Roger: Beauty from within, Kodachrome.

W. Sturgis: The preparation of liquid plasma; The regeneration of dried plasma; *the Red Cross donor program; Films made before 1942 but not previously reported here: *Malaria control; Newton conquers diptheria; **The education of diabetic patients; the Clara Barton Camp for diabetic girls; The preparation and preservation of plasma; Blood studies in shock; The mechanics of breathing at birth; Prolapse of the cloaca and urogenital sinus; A normal home delivery; Total hysterectomy; Surgical treatment of ruptured intervertebral disc; Operating room procedure, aseptic technique; Surgical pathology of hyper-pituitarism; Fractured spine—Crutchfield tongs reduction; Bone-plating for fractured femur. *Sound, **Black and white, the others are in color.

E. K. Walrath: Outdoor plant specimens. Flash with Kodachrome, 35 mm.

For information write to the person listed. Members are urged to include information as to length, size, sound and color in reporting future films. Many of these films were made by the member for others. In most cases the Committee has no information regarding availability.

III. *Committee reports.* Since many of the reports of your committee are no longer available in the form of reprints the following list of references in *our Journal* may be useful: 1935, 3:141-4; 3:194-5, (sources): 1936, 4:215-220, (standards); 1937. 5:205-7; 1928, 7:92, 143-145; 1939, 8:95-7; 1941, 9:165, 10:102.

IV. *Films reviewed by the Wistar Institute*: *Anat. Rec.,* 1942, 81:559-560, Surgical anatomy by Baumgartner, Ovulation in the frog by Rugh, The sneeze by Jennison; *Ibid* 82:129-130, Electrical stimulation . . . of the cerebellum of the cat by Clark, Development of the chick by Romanoff, Hand to mouth [infection] by Seltzer and Basil.

V. *Publications of interest*:

Beck, L. F. A second review of 16 mm. films in psychology and allied sciences. *Psych. Bull.,* 1942, 39:28-67.

Pijper, A. & L. B. Poole. A simple technique for time lapse cinemicrophotography. *J. Lab. and Clin. Med.,* 1942, 28:235-241.

Rosebury, T. Text of a motion picture; a lecture on the spirochaetes. *Ibid,* 27:1470-1486.

Rosebury, F., & T. Rosebury. A simplified aparatus for cinephotomicrography. *Ibid,* 27:1487-1490.

VI. *Film and War.* Severe restrictions are in force limiting the exposure and transfer of motion picture film. No person may expose such film at present without permission from the War Production Board. Members should obtain L-178 explaining the present emergency limitations and then apply on Form PD-763 for the necessary permission. Both of these may be obtained from the War Production Board, Consumer's Durable Goods Division, Motion Picture Section Ref. L-178, Washington, D. C.

K.K.Bosse, Oscar W. Richards, Chairmen, 19 Doat St., Buffalo, N. Y.

Forestry

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LEO C. MASSOPUST,
EDITOR

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Sodium salicylate crystals. Dark field illumination. Polychrome plate. Carbon arc illumination. Approximately 400 diameters.

Biological Photomacrography with Kodachrome Film

by Jay T. Fox*

THE general practice of photography for the past 100 years has been more or less restricted to the black and white process. Simplified processes of color photography, comparatively new, have of late been eagerly accepted by the majority of scientific photographers because of the beautiful results obtained.

After much experimenting with the various color processes, I can now without hesitancy state that Kodachrome K-135A film, when used with the proper light source will produce the truest color rendition possible of the biological specimen being photographed.

Before going into detail about the equipment and technique that I use in this field of scientific work it might be well to explain briefly, the Kodachrome process.

Kodachrome film is composed of three superimposed light-sensitive layers, each selectively sensitized to one of the three primary colors. The layer nearest the film base responds to red light, the middle layer to green, and that at the surface to blue. A yellow dye above the middle emulsion prevents blue light reaching the two lower emulsions, since these are also sensitive to blue, in addition to green and red respectively. The layers are so thin that their total thickness scarcely exceeds that of the emulsion layer of a black and white film.

After exposure, all three emulsions are first developed to negatives. Then the film is re-exposed and developed in "coupler developers" so that in the final result the negative silver images are accompanied by positive silver and dye images in each emulsion layer.

Both the silver images are then dissolved away, leaving only the composite dye image. The top layer contains an image in yellow dye, the middle one in magenta dye and the bottom one in a blue-green dye. These colors are complimentary to the colors to which the emulsion layers were originally sensitive. The final image is so balanced in color that the Kodachrome transparency, when projected with a high efficiency

* Fox Museum of Natural History, Seaford, Long Island, New York.
Received for publication March 25, 1943.

tungsten lamp, resembles in color the original subject as it was seen by the eye. Intermediate colors and mixtures are secured by partial absorption at each layer. Heavy dye deposits in all three layers subtract light of all colors resulting in a black screen image.

The finished Kodachrome film is free from all grain, as the silver grains after serving their purpose of recording the original photo image in the film, are removed in the final stage of this process. The final color images are made up of dyed gelatin, so no grain remains in the final picture. Thus in this process sharp images of fine detail are assured.

Success in Kodachrome photography depends largely upon accuracy of exposure. The chances of exposure errors in color are much greater than in black and white, due to the very limited exposure latitude of color film. It must also be remembered that the Kodachrome process is a reversal process, so that the greater the exposure the lighter the finished transparency; the colors appear to be washed out. When under-exposed the colors appear too dark, or even black.

Photomacrography is not to be confused with photomicrography. The former is a magnified photograph of an object as seen with the unaided eye, whereas the latter is a photograph of a magnified image of a microscopic object. In photomacrography, lens extension tubes are inserted between the lens and the camera, but in photomicrography the camera minus the lens is attached directly to a microscope.

In this field of small-object photography the miniature camera is most ideal, as the light metal extension tubes can be placed between the lens and the camera. They serve the same purpose as extra long bellows do on the larger cameras. These tubes come in various lengths, principally 12, 30, 60 and 90mm and can be readily attached end to end, in any combination to give the desired end result. Full information on the use of these extension tubes will be explained in a later paragraph.

My basic purpose in assembling this scientific photographic outfit was for marine biological photography. However this same unit can be used for clinical photograhy, particularly ophthalmology, otology, dermatology, etc., especially where a permanent record is invaluable for future reference by the medical staff.

WORK TABLE

A 15″x30″1″ thick black felt covered table top is mounted upon a sturdily constructed three legged cast iron support. Each leg is fitted with a ball-bearing caster permitting full mobility. The top can be raised

or lowered by means of an elevating gear or massive adjusting screw to give a variety of available heights for comfortable working positions.

Camera Support

The camera support I find most suitable consists of a table clamp into which slides a vertical pillar 1″ in diameter and 10″ long. This is adjustable in height and can be rigidly locked in place by means of a winged nut at the table clamp. A special right angled fitting is provided, the vertical portion of which moves up and down upon the vertical pillar. By tightening a set screw it can be set at any desired height. The horizontal part of the aforementioned fitting accommodates a rod that supports or carries the lighting equipment. On the end of this rod is fastened a ball-socket tripod head that allows the single floodlight and reflector to be tilted at any angle and locked securely in any position.

On this horizontal rod is also clamped a synchronous motor driven electric timer for second and split second exposure timing. This timer automatically controls the turning on and shutting off of the floodlight, thereby assuring exact duplication of results once the exposure factor is known. The floodlight is plugged into the side of the timer, which is connected to the 110 volt, 60 cycle source of electrical supply. On top of the vertical pillar is mounted a Gearmaster Tripod Head. With this precision-geared mechanism the camera can be horizontally rotated the full 360 degrees; also through precision gears the camera can be tilted and locked in the vertical plane at any angle. This support is extremely rigid, yet it permits free movement of the camera in every direction.

Camera

Not only did I desire a camera for biological photomacrography, but one that was universal in its adaptions. After much deliberation with a bewildering variety of miniature cameras, I judiciously chose a 35mm Kine Exakta, an ultra-precision built camera of wide range, manufactured by the Ihagee Kamerawerk of Dresden. Several reasons prompted my selection.:

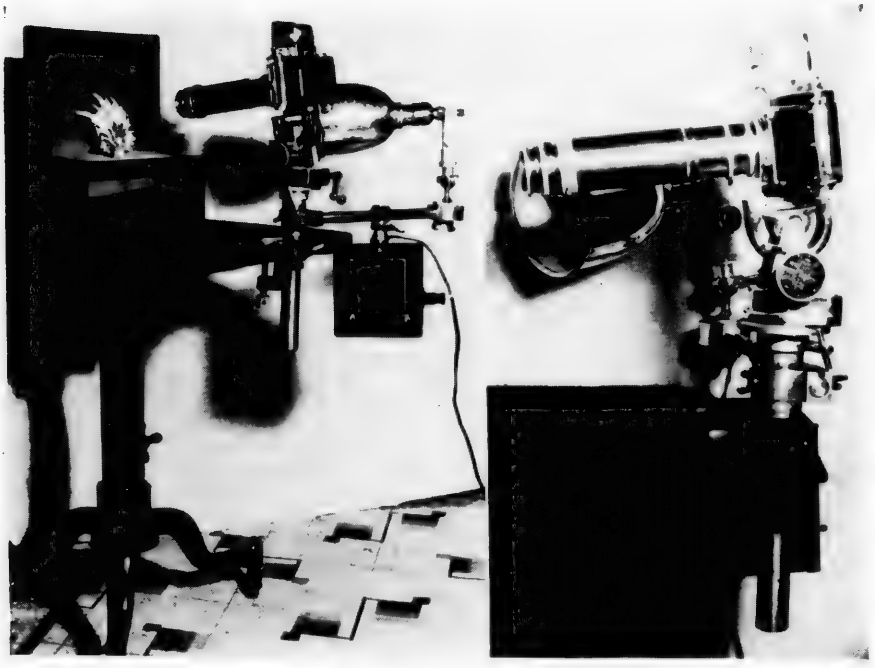
1—The Kine Exakta can be used for normal outdoor photography in the field of Natural History.

2—The various lenses can be interchanged readily by means of bayonet type fittings, and light metal extension tubes can be placed between the camera and the lens for photomacrography.

3—With a suitable attachment, this camera is light enough to serve atop a monocular microscope for photomicrography.

4—35mm Kodachrome film is purchasable in this size at reasonable cost.

5—The exclusive feature, however, is that the Kine-Exakta is the only 35mm single lens reflex precision camera on the market.



Complete unit with specimen on platform. *Closeup of Camera and support.*

6—The troubles of parallax or the use of a restricted image in the view finder, either or both of which must be inevitably found in the twin lens reflex type of camera when exposures are made at short distances, are entirely absent in this single lens reflex type of camera.

The range of work which this camera can undertake is practically limitless. The true color image on the ground glass of the Kine Exakta is precisely the same as that which will subsequently be recorded on the Kodachrome film. There is not a trace of difference between the two images, in focus, depth of focus, or field of the subject included.

Focusing is arranged just as in all other true reflex type cameras. An image is thrown from the camera lens by means of an oblique mirror (beam-splitter) upon a horizontal glass screen. Since the accuracy required in focusing the miniature negative is very great (for the circle of confusion is reckoned in this size as 1/750th of an inch) the ground glass of this camera has been combined with a special focusing magnifier. These together resemble a single, rather thick, plate of optical glass. The lower side is plane, and very finely matted, while the upper side is convex and forms a magnifying lens. The convex surface is carefully adjusted so that the focal length of the lens thus formed is exactly on the plane lower side.

Thus, when the eye is placed over the finder hood of this camera, a very bright and considerably enlarged image (4x6 cm) is seen.

A second magnifier is also provided which again gives an image twice the normal size and shows the central portion of the image only. The accuracy of critical focusing is greatly improved by this additional magnifier, and at this point is equivalent to focusing a picture 2¼x3¼ inches in size on the ground glass screen, in which case the circle of confusion need only be reckoned as 1/200th of an inch. The ease in accurate focusing places the single lens reflex camera far above all others in photomacrographic work. This camera is equipped with a focal-plane shutter to give a wide range of exposure values. The range of speeds is from 12 seconds to 1/1000th of a second.

Camera Accessories

In photomacrographic work extension tubes must be placed between the lens and the camera. This permits sharp focus to be secured at distances nearer than the lens alone is capable of focusing. The adding of the extension tubes naturally changes the "F" value of the lens. Every size of extension tube, depending on its length, has its own exposure factor which is constant for every lens. The lens that I prefer is an Exakta F-3.5 Anastigmat in a helical focusing mount. I find that when this lens (2"-50mm) is used with a combination of extension

tubes, almost any size photograph can be obtained. For example: The following tubes when used with the 50mm lens will give:

12mm	extension tube—reduction of		4:1
30mm	extension tube—reduction of		1.5:1
42mm	extension tube—reduction of		1.2:1
60mm	extension tube—Magnification	of	1:1.2
72mm	extension tube—Magnification	of	1:1.5
90mm	extension tube—Magnification	of	1:1.8
102mm	extension tube—Magnification	of	1:2
150mm	extension tube—Magnification	of	1:3
192mm	extension tube—Magnification	of	1:3.85
240mm	extension tube—Magnification	of	1:5
300mm	extension tube—Magnification	of	1:6

Easel and Backgrounds

A wooden easel and platform is constructed with a backboard 12″x12″ having two (2) 3″x3″ legs upon which rests a removable specimen platform 3″x12″. Both easel and platform are painted a dull black. For backgrounds I use an array of some twenty or more pastel shades of velvet. These are held in place by thumbtacks and can be easily changed. I always endeavor to select the most complimentary background color, keeping in mind to choose one of a subdued nature. In some cases, to give an article the appearance of being suspended in mid-air, it is supported on a piece of polished plate glass. The advantage of this arrangement is that shadows are entirely eliminated.

Technique

Emphasis must be placed upon the importance of the rigidity of the completed unit, as the slightest vibration or movement will cause failure. Place the specimen upon the platform and select a suitable velvet background. One No. 1 Floodlight (balanced in color temperature for K-135A Kodachrome Film) is turned on to provide adequate illumination. It is adjusted to properly light the specimen, then locked in place by means of the set screws. Next rotate the camera into position with the aid of the Gearmaster tripod device until the image appears on the ground glass screen properly centered. The easel holding the specimen is then manually moved backward or forward to bring the specimen into approximate focus. Next place the second magnifier against the ground glass screen to get the sharpest possible definition and extreme resolution. This hair-line sharpness is achieved through the use of the helical focusing mechanism of the lens itself. The reflected image in

its full brilliance of color continues to be visible on the ground glass screen until the very instant of exposure. Extreme accuracy in focusing is an absolute pre-requisite of success.

EXPOSURE

When the exposure is ready to be made, the floodlight is extinguished and the camera lens stopped down to F-16. The camera shutter is set as for a time exposure and the shutter is tripped by flexible cable to the open position. The exposure is made by the synchronous timer which automatically turns on and shuts off the floodlight at the predetermined setting. The actual exposure times vary with the color of the specimen photographed, the length of the extension tubes used, etc. After the synchronous timer turns off the floodlight, the shutter can be tripped manually, closing same. The film is then moved to the next frame and you are ready for the next photograph.

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Photomacrography of Minerals by Prof. B. M. Shaub
Photo Technique Magazine—May, 1940.
Photomicrographic Technique by Jay T. Fox
Rocks and Minerals Magazine—June, 1941.

LUMINOUS BACTERIA ACT AS RESEARCH GUINEA PIGS

Luminous bacteria that glow in the dark have been recruited by science to help protect war workers from contagious ills. Experiments with these "guinea pig germs" are conducted by Dr. Harvey C. Rentschler, director of research at the Westinghouse Lamp Division, Bloomfield, N. J., who reports a series of "cross-infection tests" in which germ-killing ultra-violet rays are playing a hero's role.

A harmless form of bacteria that is luminous is used to determine exactly how much ultraviolet radiation from Sterilamps is needed under varying conditions to kill germs before they can travel short distances in the air. Many of the common diseases are passed from one person to another when germs get into the air by a cough or sneeze or even normal breathing. The Sterilamp is the slender rod-shaped tube, developed for practical use in Westinghouse laboratories, which emits ultraviolet rays deadly to air-borne bacteria and viruses.

In a typical office used for experimentation, a number of Petri plates or small dishes in which bacteria can be grown are placed at various positions and luminous bacteria are sprayed into the air. Each Petri plate is then incubated for about 48 hours to allow the bacteria to grow larger. When the plates are examined in the dark, only luminous bacteria are visible, thus the investigators know how far these germs spread in the room.

Film Protection

by Samuel H. Bunchez*

THIS opportunity to discuss film protection is as welcome as it is timely, now that irreplaceable film records everywhere are threatened with sudden destruction from the air. We all know that the use of nitrate film has already been curtailed by the war, and that the same may happen with acetate film. The pictures now in use may have to serve our purposes for a long, long time before they can be replaced. It is more vitally important today than it ever has been before or perhaps ever will be again, to provide the maximum protection against any damage from climate, wear, abrasion or defacement, that may impair the projection or shorten the useful life of our now doubly precious films. After all, the emulsion or photographic film is basically just gelatin, easily damaged, ordinary gelatin.

The characteristic of gelatin, which enables it to serve certain photographic purposes better than any substitute, lies in the unique nature of its solubility. In its progress from a hard dry solid to a fluid, gelatin absorbs 10 to 20 times its bulk in water. Unlike crystaloid substances, the colloidal molecules of gelatin absorb and lose moisture slowly, at ordinary climatic temperatures. This makes it possible for gelatin to exist in various states between hard solidity and complete liquidity including, as Jack Benny tells you, the semi-liquidity of Jello.

The ability of gelatin to retain various degrees of moisture makes it an ideal carrier for light sensitive particles in photographic emulsion. In its fully hydrated fluid state it permits a thorough even admixture of the photographic elements. In its soft porous state, in raw stock, it does not disturb the dispersal of grains in winding to and from spools and it permits free penetration of the developing and fixing chemicals.

In the firmer state in which it appears on finished film its function is to hold and protect the elements which make up the picture. At this point the softness and porosity which were virtues become vices. The gelatin still contains from 1/6 to 1/8 water. Loss from or additional absorption to this normal moisture content are the root of most film troubles. Loss of moisture results in brittle emulsion. Excessive mois-

* From the Vaporate Company, New York, N.Y.
Received for publication October 21, 1942.

ture results in soft, easily abraded emulsion to the point of disintegration if carried far enough. Porosity on the other hand encourages defacement by oil, water spots and fingermarks. Consequently, after the film is finished and before it is used in a microfilm reader, motion picture projector or enlarger, adequate protection should be provided against such damage. In order to provide protection against these widely different types of damage, changes must be made in the physical properties of the emulsion which are almost diametrically opposite to each other. Liquid emulsion hardeners such as alum, formalin or the like, all work the same way by reducing the moisture content of the colloidal molecules of the gelatin. The removal of sufficient moisture softness to provide protection against scratches, etc., tends to harden the gelatin to the point of brittleness and so cause an even greater amount of distress to the film user. It is quite evident that the emulsion of the film must be toughened to resist damage from dampness, dust, abrasion, etc.; but for proper protection this must be accomplished without loss of pliability reserve; furthermore these changes in the physical properties must be permanent and unaffected by continued use of repeated cleaning.

The U. S. Office of Education emphasizes these several requirements in a specification on Defense Training films which reads: "All prints must be subjected to a permanent conditioning and protective treatment, equal to the 'VapOrate' process, resulting in a reaction directly on the emulsion itself. Such treatment shall raise the melting point of the emulsion in water and cause no loss in pliability. Such conditioning shall be effected within twenty-four hours after print is developed and dried. The type of treatment that forms a skin-like layer or varnish on the film will not be accepted." (The 24 hour provision is to prevent mishandling before the protection is provided. Films can be VapOrated any time but naturally they can't be protected against damage already caused.) VapOrate is accepted as the standard of effectiveness in film protection; it is used for this purpose by every branch of the armed services as well as other governmental departments.

In the VapOrate process the film is subjected to timed and measured chemical reactions from selected vapors. The chemicals are introduced into the apparatus in the form of liquids. These liquids are made up of elements having different vapor points and as each one of these elements vaporizes, it reacts successively on the gelatin particles in the emulsion.

The results of these successive reactions can be summed up into three major characteristic changes in the physical properties of the emulsion. 1—The water in the gelatin particle is replaced by an in-

ternal moistioner that is less volatile than water. 2—The gelatin particles are sealed permanently—sealing in the internal moistioner and sealing out fingermarks, oil, dirt, and water—the causes of unsightly stains. 3—The surfaces of each gelatin particle is toughened without loss of pliability reserve or danger of future brittleness. All this is done without any change whatsoever in appearance, color, grain, or density of the film. The chemicals affect only the gelatin. They have no effect on the celluloid, metallic silver or color dyes. The VapOrate unit treats stills, projections, positives, negatives and microfilms in this way.

Motion Picture films, because of high speed motion thru the aperture gate and around rollers require one more step in addition to the three just mentioned. Motion Picture film, in order to overcome tension and friction strain, must have surface lubrication. Therefore Motion Picture films are VapOrated in a vacuum chamber, and after the first three steps are completed, another chemical that will VapOrize only in a vacuum is introduced. This vapor provides surface lubrication. Each toughened gelatin molecule is surrounded by a film or oil. After the air is reintroduced into the chamber, the film is kept permanently but invisibly impregnated with the surface lubricant by atmospheric pressure.

The armed services, the many peacetime agencies of the National, State and City Governments, the leading Motion Picture Producers, theatrical, industrial, and educational, all agree that effective protection for photographic film is not provided by a coating easily removed in cleaning, nor is it provided by liquid hardeners which may result in brittleness. All agree that effective protection is afforded only when the film is subjected to a permanent conditioning treatment reacting directly on the emulsion itself, so as to offer maximum resistance to common causes of damage by climate, wear, scratches, spots, and stains.

Photographic Processing Control

by Louis Paul Flory*

Part II

IV. Chemical Control

USE of sensitometric data and reproducibility of results depend upon control of chemical reactions which take place during photographic processing. Determination of sensitometric values depends upon constant photographic activity of the processing baths; hence sensitometric and chemical control are complements.

The photographic activity and useful life of the processing baths are necessarily complements. Chemical control must attempt to maintain a suitable, if not constant, activity during the useful life of the bath. The following factors must be considered:

A. Compounding the baths.
B. Storage conditions.
C. Temperature control.
D. Maintenance of photographic activity.
E. Useful life.

A, B, and C have been extensively discussed by Crabtree and Matthews[5], and will only be briefly considered.

The discussion of any specific formula should not be assumed to be an unqualified recommendation by the author.

A. Compounding the Baths

Properly compounded processing baths are essential to chemical control. As water is the solvent in most photographic processing baths, use of a good grade of distilled water is recommended. Tap water varies in its chemical constituents as well as its hardness, and would introduce an additional variable into an already complex situation.

* Submitted by Louis Paul Flory. Boyce Thompson Institute for Plant Research, Yonkers, N.Y. Received for publication May 10, 1943.

[5] Crabtree, J. I. and G. E. Matthews: "Photographic Chemicals and Solutions." American Photographic Publishing Company. Boston. 1939.

An electrically-heated Stokes laboratory still (Model No. 171-J) with a capacity of one gallon of distillate per hour is part of the equipment of the chemical mixing room in this laboratory. As the hardness of the local water supply varies from 66-116 parts per million, it has been found advisable to use an all-colloidal water treatment* to prevent formation of scale in the distilling chamber. Under these conditions, a high-grade distillate is produced in quantities sufficient for normal use, and is used in compounding all processing baths in this laboratory.

B. Storage Conditions

Crabtree and Matthews (op. cit.) have covered the problems of storage of chemicals and processing solutions in stock form. In addition, care must be given to the conditions under which the baths are kept when not in use. Most baths are used in tanks which, in the case of print-processing baths, may be quite shallow and have a large surface area exposed to the air. Such tanks should be kept covered when not in use. This is obvious in the case of developing baths, but there is also evidence to show that fixing baths undergo chemical changes upon standing, with particular reference to the sodium sulfite content. Sodium sulfite is easily oxidized by the air to sodium sulfate, and this change may affect the hardening properties of the bath.

C. Temperature Control

The control of processing-bath temperatures is essential for reproducible results. Again, Crabtree and Matthews (op. cit.) have covered the subject thoroughly.

While it is preferable to use a processing temperature of 68°F, slight variations may be compensated for, provided that the variation during processing is not greater than ± 0.5°F. Using a time-temperature graph, such as is shown in Fig. 5 (page 110, Part I), the change in development time necessary to compensate for a change in processing temperature may be found, if the time-temperature curve for the desired gamma is available. Graphs similar to Fig. 5 must be constructed for each different developing bath.

In addition to indicating thermometers in processing tanks and water-bath-supply tanks, the author has found a recording thermometer —with the recorder located outside of the processing room—to be of great help. It obviates the necessity of reading thermometers by the illumination from a safelight lamp which is difficult, if not impossible,

* K.A.T., manufactured by the American K.A.T. Corp., 331 Madison Avenue, New York, N.Y.

in the case of negative processing. It also provides a permanent temperature record of the day's run.

D. Maintenance of Photographic Activity and E. Useful Life

As the useful life of photographic processing baths may be measured by the length of time during which their photographic activity can be maintained, both of these factors are complements, and can be discussed only in relation to each other. Some photographic properties of these baths may be determined by inspection of the negative or positive (stains); some by physical measurements (density and gamma); some by chemical measurements (concentration of reaction products).

Photographic processing baths naturally fall into three groups—developing baths, rinse or stop baths, and fixing baths—and it will be convenient to discuss them in this order.

1. Developing Baths

There are three methods of maintaining the photographic activity: use of a fresh developing bath for each batch of film or paper; increasing the development time as indicated by sensitometric measurements; use of replenisher solutions, either continuously or intermittently.

The first method is wasteful of solutions unless processing is on a very small scale.

The second method is feasible for the usual biological photographic laboratory, and will be discussed in detail.

The third method is usually applicable only to large-scale processing. While continuous replenishment is hardly feasible for relatively small-scale processing, intermittent replenishment may sometimes be used with good results. Much depends upon the type of equipment, and the characteristics of the developing bath.

Crabtree and Ives[6], Evans[7], Evans, Hanson, and Glasoe[8], and Baumbach[9] have made extensive reports on control of photographic activity of developing baths, usually by means of continuous replenish-

[6] Crabtree, J. I. and C. E. Ives: "A Replenishing Solution for a Motion Picture Positive Film Developer." Journal of the Society of Motion Picture Engineers. Vol. XV (November, 1930), No. 5, pp. 627-640.

[7] Evans, R. M.: "Maintenance of a Developer by Continuous Replenishment." Journal of the Society of Motion Picture Engineers. Vol. XXXI (September, 1938), No. 3, pp. 273-286.

[8] Evans, R. M., W. T. Hanson, Jr., and P. K. Glasoe: "Synthetic Aged Developers by Analysis." Journal of the Society of Motion Picture Engineers. Vol. XXXVIII (February, 1942), pp. 188-206.

[9] Baumbach, H. L.; "Continuous Replenishment and Chemical Control of Motion Picture Developing Solutions." Journal of the Society of Motion Picture Engineers. Vol. XXXIX (July, 1942), pp. 55-66.

ment, and in connection with the development of motion picture film. These references should be consulted for the explanations of the types of reaction products formed during development, and their effect upon development.

During the aging of a developing bath, not only are the original constituents of the bath gradually exhausted, but reaction products are formed, some of which act as restraining substances (usually the soluble bromides, chlorides, and iodides). Their effect upon the photographic activity of the developing bath will depend somewhat upon the type of developing agent(s) used in the bath. The effect in the case of Hydroquinone and Glycin is usually greater than in the case of a higher-energy developing agent such as Elon[10], and the borax-type developing baths are extremely sensitive to these substances due to their low alkalinity[11]. The magnitude of the effect will depend upon the quantity of emulsion developed in the bath; type of emulsion; degree of negative exposure; extent of development—for the reaction products are formed by the emulsion developed in the bath.

a. Negative Developing Baths. The following negative developing bath is usually used in this laboratory for the development of panchromatic films:

Sodium sulfite	6.0 grams
Glycin	2.0 grams
Sodium carbonate	6.0 grams
Water to make	1.0 liter

Fig. 8 shows the effect of aging upon the photographic activity of this developing bath. In the upper graph, A is the time-gamma curve for a fresh bath, and B that for the same bath after aging. At a gamma of 1.0, the development time for the aged bath is 50 minutes in comparison with 30 minutes for the fresh bath; an increase of 67 per cent. At a gamma of 0.70, the increase is 50 per cent. As it is usual in this laboratory to develop to a gamma of from 0.94 to 1.0, the bath would usually be discarded before it reached the point of aging shown in curve B, because the development time would be excessive for the processing procedure.

The lower graph in Fig. 8 shows the effect of aging upon the $D_n - D_s$ curve. Curve 1 represents a fresh bath, and 2 an aged bath, where the development time in both cases is such as to produce a gamma of 1.0. If the desired density is 1.0, $\triangle D_s = 0.08$, and the

[10] See page 90; [11] See page 95—"Motion Picture Laboratory Practice." Eastman Kodak Company. Rochester. 1936.

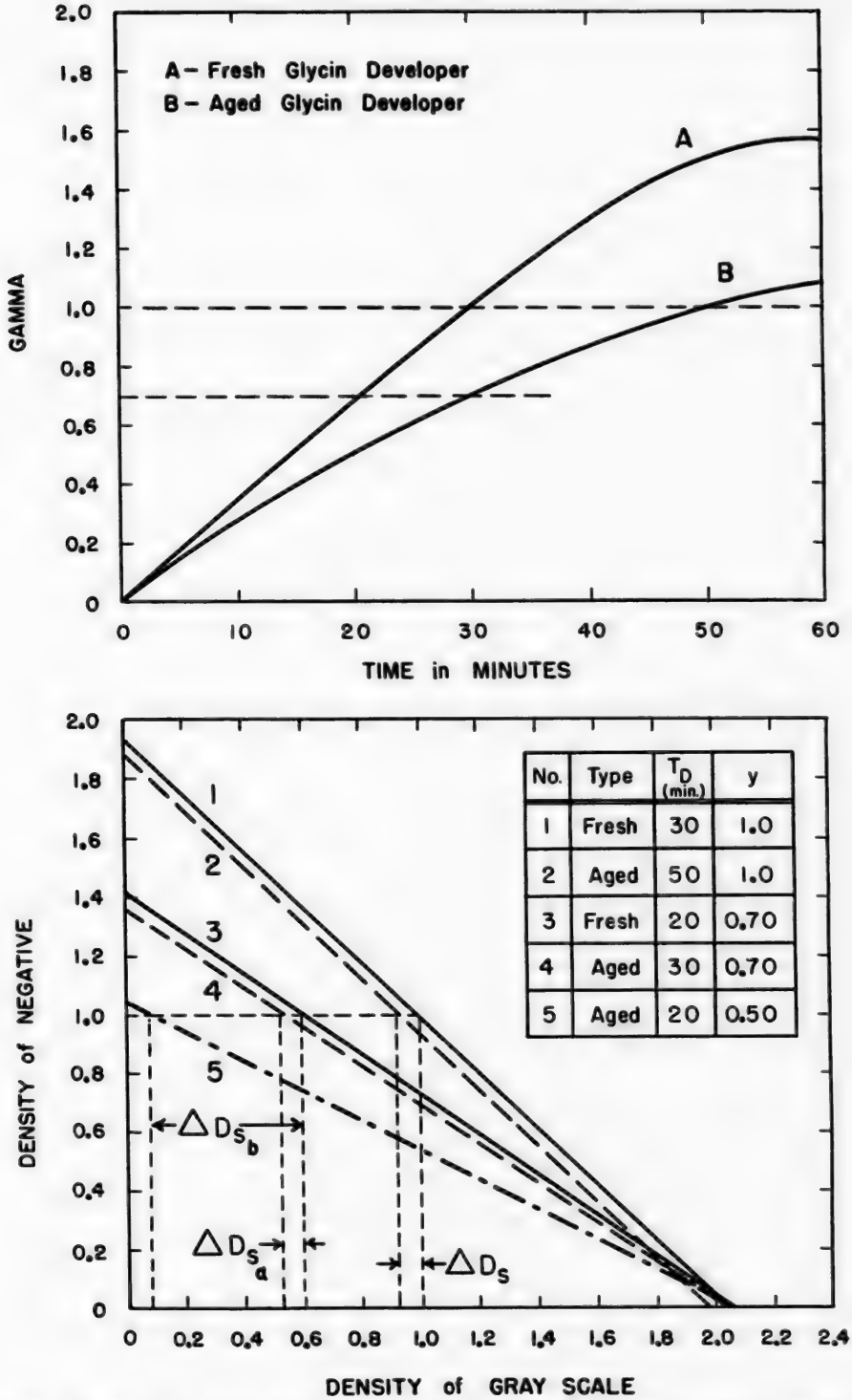


Fig. 8. Effect of aging upon a Glycin developing bath. Upper graph — Time-gamma curves for a fresh and an aged bath. Lower graph — $D_n - D_s$ curves for fresh and aged baths.

exposure would have to be increased by 20 per cent to produce the desired density at a gamma of 1.0 with the aged bath. This would be accomplished by a change in the film speed, using Equation (5) (page 113, Part I), and substituting $\triangle D_s$ for $(D_{s_1} - D_{s_2})$.

Curve 3 represents a fresh bath, and 4 an aged bath, where the development time in both cases is such as to produce a lower gamma of 0.70. In this case $\triangle D_{s_4} < \triangle D_s$, and the required increase in exposure would be 18 per cent to produce a density of 1.0.

Curve 2 is not quite parallel to curve 1, and the loss in negative density is somewhat greater in the shadows (higher D_s values) than in the highlights. The converse is true in the case of curves 3 and 4.

Curve 5 represents an aged bath where the development time was the same as would produce a gamma of 0.70 with a fresh bath. This curve illustrates what might happen if it was not known that the bath had been aged. Instead of obtaining the desired density of 1.0, there occurred a drop of 0.26 in density, which would be appreciable. This could be avoided by increasing the exposure by *331 per cent*, as indicated by $\triangle D_{s_b}$, but the gamma produced would be only 0.50.

The depression of negative density (D_n) in the case of curves 2 and 4 is, for the most part, due to the accumulation of restraining substances in the aged bath. It is obvious that increasing the development time to produce the desired gamma usually will not produce the desired density.

While the specific developing bath employed did not show any great density depression (0.04-0.06) due to aging when the development time for the aged bath was increased from 50 to 67 per cent, Crabtree and Ives[6] state, with reference to a motion picture *positive* developing bath, that:

> After the developer has become exhausted to such an extent that the time required to produce a given gamma or degree of contrast has increased by 25 per cent or more above that required by the new bath, the quality of the picture produced by this increased time of development is likely to be very different from that produced by the fresh bath. For instance, when a developer is exhausted without the addition of replenishing solution, it becomes necessary to give more and more exposure in printing in order to obtain a desired density even if the time of development is prolonged to give the correct contrast, while the color of the silver image is apt to become redder as a result of the presence of the excess bromide.

[12] Carlton, H. C. and J. I. Crabtree: "Some Properties of Fine-Grain Developers for Motion Picture Film." Transactions of the Society of Motion Picture Engineers. Vol. XIII (May, 1929). No. 38, pp. 406-444.

The data from which the curves in Fig. 9 were plotted were taken from Table II of Carlton and Crabtree[12]. The gamma curve shows the effect of the addition of increasing amounts of potassium bromide to a borax-type developing bath upon the gamma produced for a development time of 21 minutes. As the different amounts of potassium bromide were added to *separate batches of fresh bath,* the procedure is not comparable to the natural aging of a developing bath. The gamma curve, however, shows the decrease in gamma produced by an increase in potassium bromide.

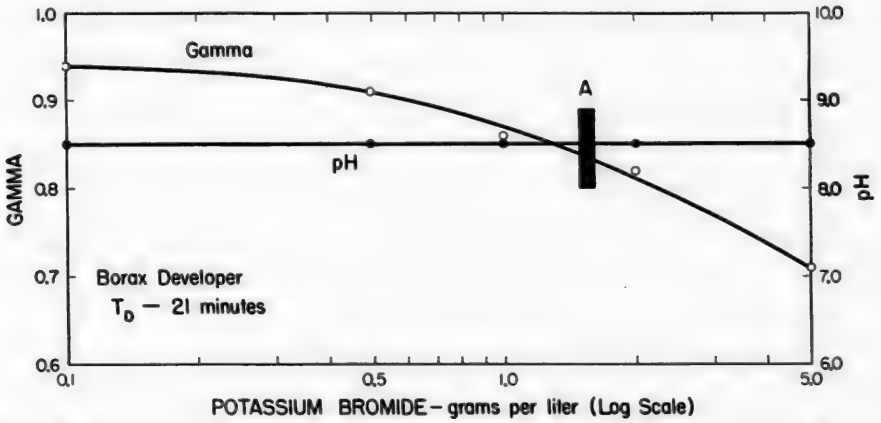


Fig. 9. Potassium bromide concentration curves showing the effect of increasing concentrations upon gamma and the pH (hydrogen-ion concentration) of a borax-type developing bath.

It was found that upon the addition of 1.5 grams of potassium bromide per liter to a fresh developing bath the film speed was reduced 40 per cent. After aging a fresh bath with 200 feet of motion picture film per gallon, the bath was analyzed and found to contain 1.6 grams of potassium bromide per liter. This range (1.5-1.6) is shown by the solid area A in Fig. 9 (referring only to abscissa values). In this range of bromide concentration, the film speed loss was accompanied by an appreciable loss in gamma for a constant development time of 21 minutes.

There have been many attempts to find a single variable the value of which would indicate the degree of photographic activity of a developing bath. Up to the present time, no such single variable has been found. Working with positive-types of developing baths, Stott[13]

[13] Stott, J. G.: "The Application of Potentiometric Methods to Developer Analysis." Journal of the Society of Motion Picture Engineers. Vol. XXXIX (July, 1942), pp. 37-54.

found little or no correlation between pH and the photographic activity, but did find a close correlation between the concentration of sodium carbonate and the activity. He found the converse to be true of negative-types of developing baths which had a lower initial pH. Evans and Hanson[14] could not find any correlation between pH and photographic activity—in fact it sometimes varied in a direction opposite to that which might be expected.

Fig. 9 shows that the pH of the developing baths remained constant although the concentration of potassium bromide differed. Carlton and Crabtree (op. cit.), however, used the LaMotte apparatus for measuring pH with a possible error of ±0.1 pH units. Evans has shown that a variation of ±0.02 pH units may cause a difference of ±0.02 in negative density. This indicates that only the potentiometric type of pH apparatus is accurate enough for developing-bath-control methods, as the accuracy of colorimetric devices is usually limited to ±0.2 pH units, and recording pH meters to ±0.1 pH units.

Baumbach (op. cit.) states that it is possible to control density to ±0.02 density units by means of chemical control, using chemical analyses and pH measurements according to the following schedule:

Type of Motion Picture Developing Bath	*Number of Analyses During Use*		
	pH	*Bromide*	*Hydroquinone, Elon, and Sulfite*
Picture Negative -----	Every 2 hrs.	1 per day	2 per week
Sound Negative -----	Every 2 hrs.	1 per day	1 per week
Positive ----------	Every 4 hrs.	Every 4 hrs.	1 per day

With such a system, continuous replenishment is necessary, and it would not be feasible to use this type of chemical control in the usual biological photographic laboratory, for the time consumed in making the analyses would be all out of proportion to the benefit derived from such a method.

[14] Evans, R. M. and W. T. Hanson, Jr.: "Reduction Potential and the Composition of an MQ Developer." Journal of the Society of Motion Picture Engineers. Vol. XXX (May, 1938), No. 5, pp. 559-567.

Crabtree[15] has published methods of intermittent replenishment, using Eastman Kodak formulae DK-50 and DK-60. Unless these formulae are used in practice, replenishment formulae and methods must be worked out for each individual developing bath.

The author prefers the second method mentioned at the beginning of Section IV, D&E-1—sensitometric measurements—for the control of photographic activity of negative developing baths. The following procedure outlines this method: *Step 1.* Start with a fresh developing bath. Make six photographs of a calibrated gray scale, and six photographs of a suitable target under working conditions of illumination, etc., as outlined in Section II, A (Part I) and Appendix B (Part I). Develop the negatives for different times of development; measure the negative densities; plot a time-gamma curve for the working temperature (usually 68°F) such as is shown in Fig. 4 (page 109, Part I). Determine the film speed which will produce the desired density for the desired gamma as explained in Appendix B (page 119, Part I), using the target density. *Step 2.* At intervals, which will depend upon the amount of emulsion processed in the developing bath, repeat the above procedure. Substitute the film speed determined in *Step 1* for S_{n1} in the equation given in Appendix B when determining the new film speed after aging of the developing bath.

Repeat *Step 2* until the increase in development time which will produce the desired gamma becomes excessive, and/or the increase in exposure necessary to produce the desired density becomes impracticable.

If all the time-gamma curves from *Steps 1, 2,* etc. are plotted on the same piece of graph paper, inspection of the curves will give a clear picture of the condition of the developing bath with reference to the development time necessary to produce the desired gamma. A record, in tabular form, should be kept of the computed film speeds and the percentage increase in exposure (or decrease in film speed) necessary to produce the desired density at the desired gamma, and the total amount of emulsion processed in the bath at the time of each test.

Even if intermittent replenishment is used, such as the methods suggested by Crabtree[15], quantitative measurements of the photographic activity of the replenished bath should be made in order to determine any variation in desired gamma and/or density, and this is a repetition of the work entailed in the method recommended by the author.

[15] Crabtree, J. I.: "The Maintenance of Negative Quality." American Photography. Part I—Vol. XXXI (November, 1937), No. 11, pp. 800-804. Part II—Vol. XXXI (December, 1937), No. 12, pp. 874-880.

All the information on the photographic activity of the developing bath necessary in applying sensitometric control, as outlined in Part I, is obtained by the above method. While it may seem to be time-consuming, the author recommends it as the logical method for the usual biological photographic laboratory.

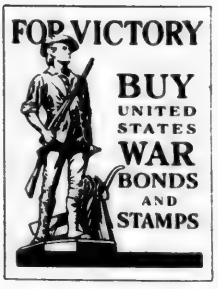
b. Positive Developing Baths. The control methods for use with negative developing baths can be applied to positive baths in the production of transparencies (motion picture film; film strips; film or glass lantern slides), where the bath is used over a considerable period of time. In the case of paper prints, and lantern slides in small quantities, it is usual to use a relatively small volume of developing bath, and to discard it at frequent intervals. When this is the case, it is not necessary to apply chemical control. Care in compounding the baths and temperature control are usually sufficient.

(*to be continued*)

ERRATA, Part I.

Page 106, line 14, "meter-candle-seconds" should read "meter-candles".

Page 117, line 33, "0.10" should read "0.02". (Note: working curves, such as Fig. 3, are plotted on rectangular coordinate paper, 10 x 10 to the half inch. In the case of Fig. 3, each subdivision—equal to 1/20 inch—was made equal to 0.02 density units, but is too small to be shown in the photo-mechanical reproduction).

★ 

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Filing Photographic Data

by R. McV. Weston, M.A., A.R.P.A.*

OVER a period of years the average photographer will probably accumulate quite a large collection of photographic data. At any moment, a particular item may be required for reference in order to assist in solving some particular problem. The value of such records is nil, unless they can be found quickly and easily.

The writer keeps several sources of such information and as the method used has proved useful on very many occasions, it is thought that other workers might be interested in details and might like to try some similar system in connection with their own data.

The data which a photographer may think worth keeping are made up of items from varied sources. There may be exposure notes for some unusual set-up, optical formulae, processing formulae, articles in a score of journals, periodicals and so on.

To deal with such records the writer has found it necessary to keep three reference notebooks, several box files and a card index. The first notebook is thumb-notched with alphabetical sections and serves to hold *short* notes on any subject frequently referred to. Typical items might be:— Colour temperatures of the usual light sources and those correct for the various types of Kodachrome, formulae and charts for increase of exposure with increase of camera extension, filter factors, film speeds, Kodatron Speedlamp exposure tables, etc. This book is a notebook in the usual sense and contains chiefly data that have been ascertained from personal experience or obtained from authoritative sources.

The second book is simply an exposure record for photo-micrography and is kept for cases which are a little out of the ordinary routine and are worthy of note for use in exposure determination in the future. It is fairly large in size as it measures 13″x8″ with horizontal format. Unless a large page is used there is insufficient room for the necessary number of columns. When entering notes in the book it is convenient to start with the illuminant and work along the optical path and the

* From Houndwood Farley, Salisbury, England.
Received for publication October 7, 1942.

following headed columns are provided:— Subject, Illuminant, Collecting lens, Colour filters, Substage condenser, Iris opening, Objectives, Ocular, Extension, Magnification, Plate, Exposure meter reading (if taken), Exposure, Development, Remarks, Negative Filing number. The book is ordinarily kept with the photomicrographic equipment.

The third notebook was only started about a year ago and has already proved its value many times. In it is entered the fullest possible details concerning any unusual set-up or technique when used for the first time. Every item is from personal experience and is more or less out of the ordinary. It records the results of experimental procedures and methods of illumination which may easily slip the mind if not noted down *at the time.* Typical examples of entries in the writer's book are:— Copying 35mm. Kodachrome same size. Copying 16mm. Kodachrome frames for 2″x2″ Kodachrome slides, photographing pathological specimens (in glass jars) on cut sheet Kodachrome, data for the use of the Kodatron Speedlamp with Kodachrome, low-power fluorescence photomicrography, etc. The notes are kept in as much detail as possible and in many cases sketches of the set-up are made (with distance of lights, etc.) which would enable the apparatus to be reassembled at any time for immediate use. From time to time the book is looked over and it is surprising to find how often the solution of past problems can be of assistance to present needs.

The last source of data is published articles, and these are perhaps the biggest problem of all to deal with.

All workers doubtless read a variety of photographic periodicals and all members of the B.P.A. have the Journal. From such sources as these there is a mine of information if it can be tapped quickly and easily. The writer has been a member of the B.P.A. for a comparatively short period but acquired a complete set of the back numbers of the Journal. It was immediately seen that the index of the Journal, while adequate for one volume, was inadequate for ten volumes because there are several indexes to be consulted before any given article can be located. It was therefore decided to make a card index and do the job properly. By making out a few cards at a time, whenever there was a minute to spare, it was not very long before every article in the whole Journal was indexed and, where necessary, cross-indexed.

The index is kept up to date on the arrival of a new issue of the Journal. The grouping of the cards is a matter of personal taste but the writer keeps two main sections, one for still, and one for motion

picture work. The still section comprises, among others, such sections as: General photography, Lighting, Processing and formulae, Copying, Photomicrography, Colour, Infra-Red, Ultra-Violet, X-Rays, Clinical. The motion picture section is subdivided into:— General, Photomicrography, High Speed, Time Lapse, Surgical.

The card index has also been made up to include every article and reference in the Kodak Data Book of Applied Photography recently published in England. This is a two-volume loose-leaf laboratory reference book and it is added to from time to time. Being a looseleaf book it has no comprehensive index of its own and the card index is very valuable.

The writer does not keep all the usual photographic periodicals seen from time to time but is in the habit of retaining only those pages which are or may be, of interest. These sheets have accumulated to a considerable quantity of articles (reprints, extracts, photographic copies and published data of one sort and another. Being loose papers, they are kept in box files and are grouped under such headings as:— Materials, Cameras and apparatus, Light sources, Colour filters, Copying, Exposure determination, Optical, Ophthalmic, Colour, Infra-Red, Ultraviolet, and fluorescence, X-Ray, High speed photography, Motion picture and time-lapse, Microscopy and photomicrography. Each group is kept in a folder and several folders are contained in one box file. At the time of writing, these are being added to the card index so that in course of time the index will contain cards, in suitable groups, giving all references on any particular topic to be found in a variety of authoritative sources. It should be possible to put one's finger, in a few moments, on all the references one has on such a subject as, say, Fluorescence microscopic or Eudoscopic motion picture photography.

The amount of work involved in keeping the notebooks and index up to date is very small, a few minutes each week, but as it grows in size so it grows in scope and usefulness. To sit down and start to index all one's photographic data might be a big task but fortunately this is not necessary as it can be done better bit by bit.

It is suggested that some method of indexing must be used if the full benefit is to be obtained from articles appearing in periodical form, and members of the B.P.A. might do well to commence some such system for their own convenience and advantage. The most detailed and authoritative information is useless if it cannot be found rapidly and with certainty.

CHATS WITH THE EDITOR

Ex Cathedra[*]

OBLIGATIONS

WE have recently read the address of the President of the Biological Photographic Association of America. For many years now we have looked out for the Association's journal, and on many occasions have obtained most valuable information from it. The President in his address dealt with the early years, the problems and the achievements of the Association, and in his final words said: "One obligation which is becoming increasingly apparent is that we are expected to co-operate with other organizations when our services appear to be valuable. This we should be proud to do." That not only indicates recognition of an obligation, but expresses an attitude towards it that we admire immensely. Too often are obligations grudingly admitted and every attempt made to fulfill them in the most perfunctory manner, here, however, we have not only full recognition but also pride in fulfilment. We are certain that is the right attitude and one that individuals as well as corporate bodies would do well to emulate.

We do not always realize that achievement does not call for cessation of action, but rather for an intensification of effort. In many cases that intensification is due to effort being spread over a greater area, and calling for co-operation with an increasing number of fellow-workers; it is that co-operation that we should be proud of. It would be very easy to cull examples from today to strengthen our suggestion, there are so many examples of the necessity for and value of co-operation, but surely people can think of those for themselves. What we like so much is the association of pride with the fulfilling of obligations. That says so clearly that what we have done we can be proud of and so can take

[*] Reprinted from the British Journal of Photography, Vol. XC, No. 4322, March 5, 1943.

pride in that which we are about to do. Further it means very clearly that not only do we co-operate willingly but are delighted and proud to do so.

* * * *

PRIDE

We can only be proud to do so if we are satisfied that our own work has been competent and praiseworthy, in a word we can only be proud to help others if our own work is a source of pride to us.

Now we may appear to be labouring this point, if so it is because we feel very strongly that a little more pride in work properly done might not do us any harm. There is plenty of very good work being done these days, but there is also far too much that can by no stretch of imagination be called good. To no small extent this poor work is due to lack of care, lack of taking pains. Largely, one can trace much of it to slipshod methods, scamping certain operations, sometimes to deliberate carelessness. Only recently we had to look through a series of photographs which had been prepared from time to time to record progress in a certain rather complex erecting job. There were perhaps two dozen in all. Of these well over half were very poor indeed. Little care had been taken to ensure adequate lighting, in one or two cases focussing was careless, some were soot and whitewash, and yet perhaps half a dozen were quite good. They had all been taken by the same person with the same apparatus. They had been used to illustrate reports on progress, but now the question of providing an illustrated account of the work had been mooted, and we were asked what we thought of the records. What could we say? Simply the truth, that about half the photographs were so poor that it would be very unwise to attempt using them all together to illustrate a connected narrative, as attention would inevitably be drawn to the widely varying quality of the photographs. No one can take any pride in work of that sort, and it is impossible to escape the conclusion that such bad work is unnecessary and never should be permitted. It probably took just as long as good work, and involved as much trouble, and all for what?

* * * *

STANDARDS

The founders of the Biological Photographic Association of America had as one of their principal aims the "establishing certain standards of quality and elevating those standards to the highest degree." It is because they and their fellow-members have kept that aim steadfastly

before them that today they can be proud to co-operate with others. Among all the problems that confront us now, and perhaps increasingly in the post-war period, we feel that perhaps the most serious for each one of us is that of our own personal integrity, for upon that will depend our contact with, effect upon, and reaction to our fellows. In one sense we believe we could use as a touchstone this very matter of pride in our work and pride in our co-operation with others as a guide or leader for ourselves. If we are proud of our work, if we can go forward proud to place our knowledge and experience at the service of others, then we can be reasonably sure that we have not done badly and that we have not scamped our work. If we can continue in that path we can be sure that our contribution to reconstruction no matter how small or insignificant it may be, is at least honest. We can know too that we have not been wanting in our duty to ourselves and our fellows, that we have been decent citizens doing our share, playing our part, paying our way and proud to have been able to do so. All this lies behind that pride in co-operation, it links up with the standards we should set ourselves and the view we should take of our obligations.

In all the talk about what is to be done and the means whereby we can do it, we feel that the most important unit of all is perhaps being overlooked. That unit is ourselves, each one of us. The future, so far as we are concerned, depends upon us. That is a responsibility we can in no way shirk even supposing we wished to do so, it is a responsibility we can be proud of if we but see it in the right way.

☆

BUY WAR BONDS

***Every* PAY DAY**

☆

A Flexible Low Power Stage

by Arthur L. Smith*

DISPLAYED at the 1942 Biological Photographic Association Convention was the low power stage illustrated below. It was designed for low power photomacrography and can also be used as a general stage for small objects. Of current importance is the fact that it was built completely of scrap material and utilizes standard condensers. These are the Leitz low power series—120mm, 80mm, 50mm, and 35mm. Flexibility is its justification, for it has a rack and pinion adjustable stage, complete with a mechanical stage for centering the subject to the camera. A large substage mirror is adjustable by a universal joint and a rack and pinion height control. Four leveling screws adjust rubber feet which are converted rubber stoppers. All adjustments on this equipment have tension screws to insure firm-

*Cornell University, Department of Zoology, Ithaca, New York.
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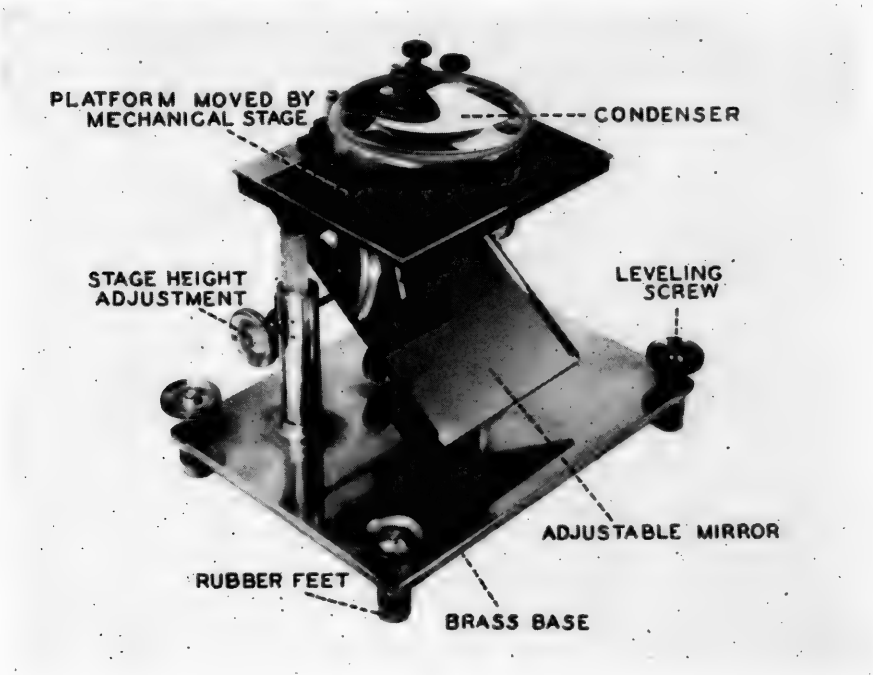
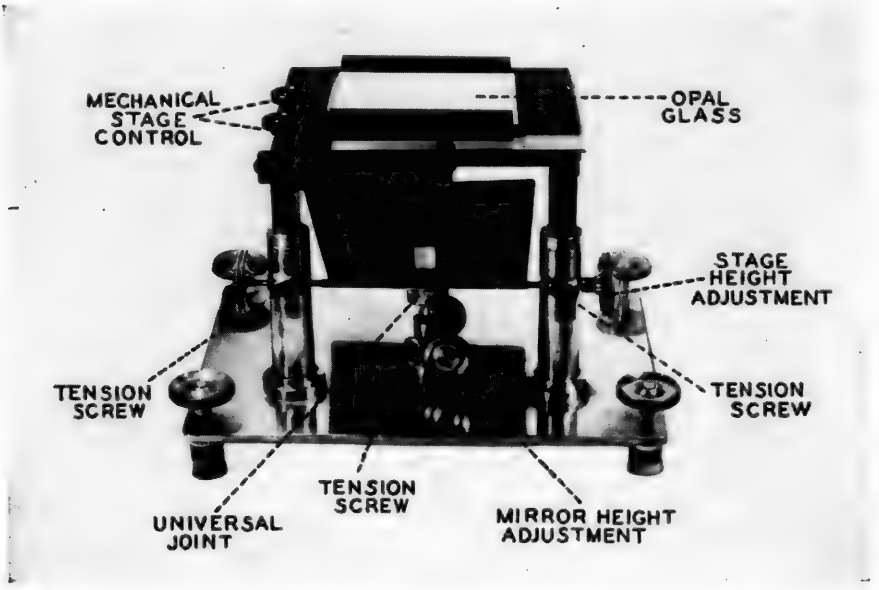


ness of movement. The top of the stage may be removed to leave a flat platform for general small specimen photography, since there are many instances where it is easier to focus the object by moving the stage up or down, rather than the camera. Removal of the condenser only leaves the mechanical stage with a 3x4 inch opening which may be illuminated from below or covered with an opaque material. When substage lighting is used, opal glass or other materials may be placed on the rectangular stage opening.

Although the stage described is not available commercially, it does represent a suggestion for a flexible and essential part of photomicrographic apparatus and it is hoped that such an instrument will be considered by the optical companies for possible post-war manufacture. Presently available commercial low power stages seem generally inadequate for the needs of such work. The non-flexible Bausch and Lomb stage utilizes a maximum condenser size of 1¼ inches diameter. The



equally non-flexible Leitz stage utilizes a more useful series of condensers, maximum diameter being 4 inches. Whereas standard low power *objectives* are quite satisfactory, present *condenser* and *stage* apparatus is very crude compared to advances in other instruments. Construction of the equipment illustrated was done by Mr. B. R. Macmillan, the scientific instrument maker of this laboratory.

Photography and Medical Education

by Wilson Footer, M. D.*

THE technics of teaching medical subjects has fallen far behind the advances made by the science itself. Whereas the methods of diagnosis and treatment have changed markedly, the same antiquated methods are used to impart this knowledge to the student that were in vogue centuries ago. There are many inadequacies associated with the simple lecture, illustrated at times by mummified specimens, or the surgical amphitheatre where the fortunate observer may obtain a vantage point for only a few moments. In the clinics at best he sees but a small number of cases illustrating even fewer conditions. It is argued that the student needs to grasp only the essentials of medical practice during his institutional years, that the finer points in diagnosis and treatment must be gleaned from years of practice. But the present system falls short even here, for it fails to coordinate theory and practice. Inertia on the part of the instructors coupled with an overcrowded schedule stifles any attempt to radically change the methods of instruction. But the main difficulty lies in the failure in over-all planning of the medical curriculum. Many studies have been made and the recommendations are generally that there should be so many hours spent in each of the different courses. The quality of the presentation of these is of necessity extremely variable depending upon the ability of the instructor. It is here that the standardization of presentation by the use of slides in color and motion pictures can assist the inadequate instructor and broaden the usefulness of the good one.

In general, a person learns a subject quicker and more thoroughly when it is presented to him by both auditory and visual stimuli. Of the visual stimuli colored slides, motion pictures and three dimensional models are most effective because they more closely approach the actual appearance of the material under discussion. Slides and motion pictures are more easily and economically prepared and reproduced. To effectively incorporate these into a teaching program there must be available a large and varied amount of material which is difficult to

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accumulate in any one institution. In one hospital a doctor may record surgical operations and findings, in another lesions of the cervix, in another rectal findings, photomicrographs and so on through the entire field of medicine depending upon individual interests. In our own institution the Department of Pathology records in color all autopsy findings supplemented by color photomicrographs, and the Department of Obstetrics and Gynecology records obstetrical findings and procedures, cervical, vaginal and vulvar lesions and gross specimens removed at operations, and in addition records the x-rays of illustrative cases. The other fields have very incomplete coverage but color photography on 35 mm. film of operations is gaining in popularity. Thus we routinely present color slides to the students and staff at clinical pathological conferences, and color slides together with 35 mm. reproductions of x-rays during the lectures and ward rounds in obstetrics and gynecology. Although the files in both departments are growing rapidly they are far from complete and could be supplemented by slides from other hospitals if only they could be made available. We in turn probably could add valuable material to other collections. Therefore it seems essential to have a central organization to facilitate the distribution of these and to encourage the incorporation of such progressive methods in medical schools where they are now too infrequently used.

For success in this enterprise there is required first a central organization capable of obtaining the cooperation of the medical schools and large hospitals maintaining photographic departments. It is essential that this be done now before there can develop the chaos of decentralization at present preventing the effective use of medical motion picture films (1). For many years medical motion pictures have been made by individual physicians, hospitals, commercial photographers and houses, but as yet their teaching value is markedly limited because no organization has been able to act as an authoritative center for distribution of all such films. As a result it has been difficult to incorporate them into a teaching program. Because of this, medical schools have either failed to realize their value or are reluctant to take the trouble to collect from many sources the motion pictures of varying quality needed to illustrate any particular course. Consequently a plan has not been adopted for the entire medical curriculum. Secondly, there should be standardization of the size of slide to be used. In view of the increasing use of the

[1] Coryell, H. V. The Present and Future States of Medical Motion Pictures. Medical Economics. 20: P. 39 Oct., 1942.

[2] Johnson, George F. Recent Trends in Visual Instruction J. Biol. Photographic A. 10: 35-41 Sept., 1941.

economical 35 mm. color slides (2), it would seem advisable to convert all other sizes, both black and white and color, to 35 mm. for distribution.

The Biological Photographic Association, having members among the photographers and staff members of many educational institutions, appears to be the logical choice to incorporate this service within its organization. Further it will be necessary to present convincingly to the medical schools the value of slides and motion pictures as essential accessories in almost every course. It must be made easy for them to obtain all of the material necessary to illustrate all of their courses.

Ultimately, of course, it will be desirable to be able to obtain all material for illustration from one source. This ideal should be the goal toward which we strive and when the time comes for the amalgamation of these services we should facilitate its accomplishment.

AVIATION MEDICINE

Some day when the Censor's office is vacated and closed we should have interesting facts to learn about the various new techniques evolved to meet war-time requirements. Some of these are developing in the field of aviation medicine. Mr. Lardner Coffey writes from the Section of Photography, Mayo Clinic:

"Strict war-time censorship prohibits a detailed description of the work involved. The research work in aviation medicine is being done under contract with the Army Air Corps and in cooperation with the Office of Scientific Research and Development. So I am permitted to say little more than that the work represents many new problems that ordinarily would not arise in the routine tasks of the medical photographer."

Obtaining Photographic Supplies

A B.P.A. Director suggested we could help our members by sending out an instruction sheet telling what forms to fill out in order to obtain photographic supplies, and through what channels to apply. This suggestion was submitted to the other Board members by mail, and a majority voted it a helpful procedure. The Secretary was in the process of compiling the information when a new regulation was issued giving hospitals an AA-1 rating, and dispensaries, educational institutions, etc, an AA-2X. With these ratings basic supplies could be bought without making application to the WPB. A limited amount of equipment could also be ordered. As a great many of our members were affected by this regulation, an instruction sheet on how to obtain ratings for individual orders would have interested only a small fraction.

At present still another regulation has come out. This is an amended form of WPB's order L-233 on film restrictions. It takes films out of the class of supplies that can be bought on the high ratings accorded institutions, and means a return to the PD-1A application forms for all purchases. These forms are to be sent to the local WPB Boards where they will be rated if under $100. If larger, they will be sent to the Washington WPB for rating.

With new regulations appearing so suddenly, an instruction sheet could become obsolete while it was still in the mails. Then too, supplies vary in different parts of the country, so that the simplest procedure in one city may not be feasible in another. Obviously your local dealers are the ones who can best advise you about the promptest, most effective way of keeping up your stock.

However, if you are having trouble getting supplies for essential work, please write this Association. Give concrete information about the materials needed, their purpose, and what happened when you tried to obtain them. We do not mean that we can get individual orders filled for you—we cannot. But if we have definite details about your needs and the obstacles you meet, we can more truly represent you. The general over-all picture of our field of work and our needed supplies has been presented to the War Production Board. But for continued contact we must have definite details. The more we know the better we can present the scientific photographer's case. Please help to keep us informed.

Association News

ASSOCIATION FOR SCIENTIFIC PHOTOGRAPHY IN ENGLAND

A New Member in the Family

An Association is being organized in England to promote interest in the use of photography in all branches of science, technology and medicine. Membership is open to any person actively engaged or interested in the use of cinematography or photography as a scientific instrument. The subscription for members is two pounds two shillings per annum (about $8.50) with an entrance fee of one pound one shilling. Junior members of 18 to 23 years of age will be admitted without entrance fee for a yearly subscription of ten shillings sixpence (about $2.13). Institutions and firms may become Corporate Members, the entrance fee being one pound, one shilling and the annual subscription ten pounds ten shillings (about $44.60) per annum.

The Association maintains an information bureau listing the activities of all members and, in suitable cases, the existence and whereabouts of specialized equipment. This information will be used to facilitate personal contacts between members working in similar fields and the Association will endeavor to obtain for members, on request, information on practically any photographic problem which may arise in the prosecution of scientific work.

The printed notice issued by this organization shows certain differences between its scope and ours. It will cover the entire field of scientific work, for instance, instead of limiting itself to any particular branches. It also differs from us in singling out a particular type of photography for special notice. According to the notice, "the Association is anxious to foster the production of sub-standard films for research and teaching purposes and to endeavor, as far as is possible, to raise the standard of the method of presentation of such films, which at the present time is low." Again, no annual meeting is mentioned in the notice but it states that "meetings are held at which short papers are delivered, followed by practical demonstrations of apparatus and methods by members." At the time the announcement was sent, no such lecture meetings had been held, but it was hoped the first would take place shortly.

The Association cannot undertake a Journal now as new serial publications are not permitted in England, but they plan to publish one

as soon as possible. The membership dues are higher than ours, except to Junior members, and the dues charged institutions and firms put them in the class of contributing or supporting members. However, assuming that, as a scientific Association, the English is a non-profit venture, the motive behind the two organizations is undoubtedly the same. In fact its organizing Secretary, Mr. R. McV. Weston of Salisbury became a member of the B.P.A. in 1941, on the recommendation of Mr. Schmidt. He is in charge of the photographic section in one of the English government's research laboratories and in a recent letter to Mr. Schmidt he writes that he has found his membership and the Journal to be most useful and stimulating in his work and that "the idea behind the Association for Scientific Photography was due in large part to the Biological Photographic Association and the most useful role it plays in your country in caring for the very specialized photographic needs of the biological worker."

1943 CONVENTION

In the early spring a vote was held among the Directors and a majority favored holding the Convention this fall if possible. The minority voting against it felt that as other organizations were calling off their conventions, we should do likewise. It is true that many groups are not meeting; it is also true that others, some of them far larger than we are, are still holding Conventions. The majority of our Directors feel that since a group the size of ours will not tax transportation and accommodation facilities, we can meet for the advancement of scientific photography and still be patriots.

However, the situation can change on short notice. According to the papers, Transportation Director Joseph B. Eastman will institute "a rigid system of rationing travel" unless there is a voluntary adjustment of travel habits to meet wartime conditions. Our plans therefore must still be tentative. And our choice of meeting-place must depend more on circumstances of transportation and accommodation than on Association logic. After meeting in New York last year we would normally go to the mid-west this year. But the majority of our members are in the east, so that the further west we go the more railroad service we would require. Also, we must avoid cities congested by the armed forces or war industries. These combined circumstances point to a fairly small city within easy reach of New York City as the best compromise. The accommodations in Princeton are being investigated with the help of our member Mr. Julian Carlile.

In spite of the need of flexibility we do not want to become casual about the Convention. Quite the contrary, for if we are to justify our meeting this year we must do our utmost to make it as worth-while as possible to our members and to scientific photography as a whole. If you have any ideas for making this a particularly worth-while convention, please send them in. We count on your cooperation in assembling a program that is pertinent to the times, and a Salon that lives up to B.P.A. standards even in these busy days. A letter will reach you later with details of the time and place.

F L A S H !

Your Salon Chairman has just been advised that, as matters now stand, the annual convention will again take place. Convention means Salon . . . Salon means prints, hundreds of them . . . and that means marking down August 1st as a reminder date to get your prints ready.

Everyone seemed to agree that the 1942 Salon in New York was highly successful. A large number of fine prints were hung—mostly the work of our members. As we have emphasized in past years, the Salon is a particularly important phase of the annual convention. The various speakers report on, and describe, their work and research—a composite word picture of "what's what" in scientific photography. The Salon, on the other hand, demonstrates *visually* the actual results of this work and, in many cases, exemplifies the saying "One picture is worth a thousand words". We are not, of course, inferring that the Salon is more important than the program of speakers. The Salon and "the program" should be considered as having a vital inter-relationship—one enhances the effect of the other.

You, as a scientific worker, can make a definite contribution to the study of photography by sending examples of your work. To you, they may be "just jobs", but to other B.P.A. members they may be of great interest and value. What is commonplace to you may be remarkable examples of technique to workers not familiar with your particular field of endeavour.

In this brief article we have tried to impress you with the importance of having a salon, representative of the work of *all* members. As has been stated before, if each member sent only two prints we could have one of the most outstanding scientific exhibits in America. Please . . . won't you plan right now to send in several examples of your work?

You will not only further the work of your association but you will be making a definite contribution to the study of scientific photography.

NAT. S. HORTON,
Chairman, Salon Committee, 1943.

NEWS NOTES

Lieut. C. G. Eddy, officer of the first unit of the Museum and Medical Arts Service to go into active duty, has reached his station in a foreign country. The following excerpts from letters, written by two of Lieut. Eddy's men to members of units still at the Museum, speak well for the morale in Lieut. Eddy's group:

"We certainly got a swell officer when we got Lieut. Eddy. He got himself in solid with us during the trip, and I know he'll do his best for us over here."

"Lieut. Eddy has proven to be a regular fellow and a fine officer, and I'm glad to be working with him and the boys."

The Board of Directors takes pleasure in announcing the appointment of Mr. Lloyd Varden to fill the vacancy caused by Lt. C. G. Eddy's resignation. Most of our members know Mr. Varden's work; many of us know him personally. He has lately published studies on the visual mechanism, photography of eye-movements, sharpness considerations in making scientific illustrations, fluorography, and other subjects. Until recently he was in the Product Information Department of the Agfa Ansco Co. in Binghampton, N. Y., and edited the *Agfa Oiamond.* Last summer he took leave of absence from the Afga Co. and went to Washington as Chief of Photographic Films and Papers Unit in the Motion Picture and Photography Section of the War Production Board. It is fortunate for scientific photography that a man who understands its purposes and needs so fully should have a part in shaping the policies of the WPB's Photographic Section.

Mr. Varden joined the Association in 1939. He entered as a Sustaining Member and has remained in that group. He has consistently attended our Conventions ,not only as a representative of the Agfa Co., but as one of our most active members. The Directors are gratified that in spite of pressing and complex duties in Washington he has signified his willingness to serve on our Board. It is with sincere pleasure that we announce his appointment as a Director of the B.P.A.

Many of our members will remember meeting Charles G. Brownell of the Eastman Kodak Company at our meetings, and will be interested

to hear he has reported for duty with the Museum and Medical Arts Service of the Army.

Dr. Gemma Barzilai, now of New York City, who was formerly a member of the Vienna Women's Clinic and other European institutions, has published an *Atlas of Ovarian Tumors,* abundantly illustrated. This book is a fine example of the modern type of diagnostic Atlas made possible by scientific illustrations.

Dr. Barzilai joined the B.P.A. in 1942. She attended our New York Convention last fall.

"In a hold-up a few years ago the only evidence left behind was a brief-case. On the outside flap of the brief-case an area had been defaced by means of abrasive or a sharp instrument. A few scattered particles of gold were still contained in the erased area, indicating that a name had been imprinted in the leather. Obviously the name could not be deciphered. Various photographic methods failed to reveal any information."

These are the opening sentences of an article on "Helpful Hints in Preparing and Photographing Materials for Identification", written for the International Association for Identification Bulletin by our own Editor, Mr. Leo Massopust. Where photography failed him, liquid polishing wax did the trick. However, in a subsequent paragraph Mr. Massopust returns to his old love, infra-red photography. In this instance, a felon was killed by a gun-shot wound in the chest. Important papers in his coat pocket were saturated with blood. But the combination of a 500 watt bulb, a No. 87 filter, an infra-red plate and Mr. Massopust, revealed their contents. Those of us who remember his fine infra-red work in some of our former Salons will not be surprised.

CHAPTER NEWS

The two B.P.A. Chapters that have survived these strenuous days are the Chicago and the Pittsburgh. Miss Avis Gregersen, Secretary of the Chicago Chapter, sent the following report on the year's activities:

"I wanted to report our new nominations and election of officers for the coming year. Our group like all other groups has been hit by the war and a number of our men are now in uniform and not with us any more. Among our outstanding members in uniform are the following: Capt. Ralph P. Creer, and Major Tibor Benedek, Private George W. Reis, and Jay Abbott now in Washington on some kind of board. It so happened that all but Mr. Abbott were officers so we had to do a great deal of reorganizing.

"This is the result: President: Mr. John Maurer; V. President: Dr. Jay Garner; Secretary: Miss Avis Gregersen; Treasurer: Miss Marie Elsasser; Directors: Mr. Marshall Clemeau, Mr. Wm. L. Martinsen, Mr. A. Hapke. If any change in the status of the above members and officers occurs, due to war activities, other members will be substituted for the remainder of the year.

"We have had several very interesting meetings of late:

December: Mr. D. C. Donaldson of E. K. Co. discussed photoengraving.

January: Mr. Thomas Hill of Edwall Laboratories discussed Film Development.

"February: Dr. Jay Garner reviewed his excellent movie 'Proctoscopic Cinemaphotography' by himself and Dr. Nesselrod. As you probably already know, twenty copies of this film were made by the U. S. government for circulation among our Central and South American neighbors. The original film is still in Washington, D.C. We feel very proud of our new Vice-President!"

The peak season for the Pittsburgh Chapter was 1940 when we had 35 members. At the close of this season we have 25—not too bad for these days. Of the 25, only 5 do photography as part of their professional work. The others are almost all scientists with an interest in photography but little time to devote to it. This type of membership means small attendance at meetings. Organized sessions with formal speakers are hard to arrange under these conditions so the Chapter attemped only three formal sessions, one a motion-picture program, one a talk on dental photography, and one a visit to a projection session held by a larger pictorial group. The other four programs were informal demonstrations of the following subjects: Use of the Color Temperature Meter, Exposure and Processing of Autopositive Paper, Various Methods of Copying Kodachrome in Black-&-White, Reduction of Underexposed Kodachromes, Set-ups for Photomicrography.

For the meeting on photomicrography we had the Pittsburgh Chapter of the American Society of Amateur Microscopists as our guests. At every meeting we tried to divide the attendance into groups of four or five, and rotate the groups, so everyone could see each step of the demonstrations plainly.

Our members found this type of meeting interesting and have voted to continue the plan next year under even more informal conditions if necessary. No election of officers was held, but the Secretary was directed to call the first meeting in the fall, at which one or more officers could be appointed if circumstances warranted.

ANNE SHIRAS, *Secretary*
Pittsburgh Chapter

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